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Chemically Active Fluid-Bed Process for Sulphur Removal During Gasification of Heavy Fuel Oil - Third Phase

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16. ABSTRACT

The report describes the third phase of studies on the CAFB process for desulfurization/gasification of heavy fuel oil in a bed of hot lime. Major conclusions relating to process performance and operability are: (1) water, either in the fuel or in the fluidizing air, has a strongly adverse effect on desulfurizing efficiency; (2) good desulfurizing efficiencies are obtainable at very low stone replacement rates; (3) process performance can be expressed as a statistically derived equation; (4) a burn-back burner is feasible for coke removal; (5) SO2/stone disposal by sulfation is not feasible, but dead-burning looks promising; and (6) most trace elements are retained in the bed. Among tasks included in this phase were: (1) batch reactor evaluation of three limestones and gasification/desulfurization of a vacuum bottoms fuel; (2) two pilot plant runs using deep beds and demonstrating improved operational techniques; (3) development of a statistical method for analyzing results of the two pilot plant test runs and reconciling them with earlier results; (4) sulfation of bed material as a means of disposing of SO2 and spent lime; (5) dead-burning as a means of treating spent bed material prior to disposal; (6) retention of the bed material of a wide range of trace elements contained in the fuel; and (7) demonstration of a burn-back burner to overcome coke lay-down in cyclone inlets.

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Fluidized Bed	Fuel Oil	Stationary Sources		21D
Processors	Calcium Oxides	CAFB Process		
Regeneration	Limestone	Chemically Active		08G
(Engineering)		Fluidized Bed		
Sulfur		Fluidized Lime Bed	07B	
Desulfurization		Heavy Fuel Oil	07A, 07D	

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(Third Phase)

by

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CONTENTS

Page

ACKNOWLEDGMENTS iii

LIST OF FIGURES vi

LIST OF TABLES viii

I INTRODUCTION 1

II SUMMARY 9

III CONCLUSIONS 11

IV RECOMMENDATIONS 17

V DISCUSSION

BATCH STUDIES
- Fuels and Limestones 19
- Burn-Back Burner 23
- Dead Burning and Sulphation of Spent Lime 49

CONTINUOUS STUDIES
- Analysis of Continuous Runs 8 and 9 71
- Retention of Trace Elements 101
- Materials of Construction 109
- Modifications of Equipment and Operations 115

VI APPENDICES 119

A - Batch Tests on Limestones and Fuels 119
B - Burn-back Burner Test Results 128
C - Spent Lime Weathering Results 153
D - Sulphation Test Results 184
E - Modifications to C.A.F.B. Pilot Plant for Runs 8 and 9 204
F - C.A.F.B. Run 8 Operational Log, Inspection and Data 210
G - C.A.F.B. Run 9 Operational Log, Inspection and Data 340
H - Programmes and Methods of Analysis of Continuous Run Data 532
I - C.A.F.B. Pilot Plant Description and Operating Procedures 546

CONTENTS (Continued)

Page

VII GLOSSARY OF TERMS 592

VIII REFERENCES 593

IX PATENTS 594

LIST OF FIGURES

		Page
1.	Overall Programme of Work	2
2.	Reverse Airflow Decoking Burner	24
3.	Line Diagram of Batch Unit	25
4.	Coked-up Primary Air Pipe	30
5.	Coked-up Gasifier Gas Duct	31
6.	Partially Decoked Primary Air Pipe	32
7.	Decoked Gasifier Gas Duct	33
8.	Decoked Primary Air Pipe	34
9.	Decoked Primary Air Pipe (close-up)	35
10.	Burn-out Gas Analyses During Run No.3	37
11.	Burn-out Gas Analyses During Run No.5	38
12.	Burn-out Gas Analyses During Run No.7	39
13.	Pressure Across Gasifier Gas Duct as a Measure of Duct Decoking/Coking	41
14.	Variation of Rate of Gasifier Gas Duct Coking with Gasifier Bed Air/Fuel Ratio	43
15.	Flame Stability - Primary Aeration Diagram for Experimental Burner	45
16.	Combustion Diagram for Burn-back Burner	47
17.	Possible Full Scale Version of Burn-back Burner	48
18.	Optimum Temperature for Sulphur Oxide Absorption by Lime (31% of Bed Reacted)	51
19.	Rate Controlling Factors for Gas-Solids Reactions	52
20.	Pore-size Distribution of the Calcined and Sulphated Stone	56

LIST OF FIGURES (Continued)

Page

21. Sulphation Profile for Run No.3 58

22. Potential Continuous Feed Sulphator 60

23. Weathering of Sintered Spent Lime 64

24. Weathered Sintered Spent Lime after 12 Months 65

25. Effect of Weathering on Sample Temperature for Sintered and Non-sintered Spent Lime 66

26. Effect of Weathering on Molar % Total Calcium for CaO and $Ca(OH)_2$ 67

27. Effect of Weathering on Molar % Total Calcium for $CaCO_3$, CaS and $CaSO_4$ 68

28. % S.R.E. Versus Gasifier Bed Depth (Runs 8 &9) 80

29. % S.R.E. Versus Gasifier Bed Temperature (Runs 8 & 9) 81

30. % S.R.E. Versus % Air/Fuel Ratio (Runs 8 & 9) 82

31. % S.R.E. Versus Cyclone Temperature (Runs 8 & 9) 83

32. % S.R.E. Versus Added Water (Runs 8 & 9) 84

33. % S.R.E. Versus Ca/S Mole Feed Rate (Runs 8 & 9) 85

34. % S.R.E. (Residual Error) Versus % Bed Fines (600-250μ) 89

35. % S.R.E. (Residual Error) Versus Bed Sulphur (Wt. %) 90

36. % S.R.E. (Residual Error) Versus Bed Sulphate (Wt. %) 91

37. % S.R.E. (Residual Error) Versus Bed Carbon (Wt. %) 92

LIST OF TABLES

		Page
1.	Mean Values of S.R.E. and Bed Depth	12
2.	Compositions and Properties of Fuel Oils Used in the Batch Test Programme	19
3.	Chemical Compositions of Limestones Tested	20
4.	Summary of Batch Unit Loss Rates	21
5.	Lined-out S.R.E.'s for Candidate Stones	22
6.	Temperature Increase during On-stream Gasifier Gas Duct Decoke	27
7.	Comparison of Gasifier Product Gas Compositions from Batch and Continuous Units	36
8.	Measure of the Rate of Gasifier Gas Duct Coking	42
9.	Range of Burner Parameters giving a Stable Flame	46
10.	Fluidised Bed Batch Tests	54
11.	Sulphur in Stone Fractions	55
12.	Continuous Spent Lime Feed Fluidised Bed Sulphation Tests	61
13.	Effect of Temperature on Spent Lime Acitivity	63
14.	Leachate Analyses	70
15.	Summary Statistics for Runs 8 and 9	73
16.	Linear Regression Equations to Predict % S.R.E. for Runs 8 and 9	76
17.	Prediction of Run 8 Data from Run 9 Regression Equation and Vice Versa	78
18.	Comparison of Polynomial Expression and Linear Expression for Regression Variables	86

LIST OF TABLES (Continued)

Page

19. Polynomial Regression Equations to Predict % S.R.E. 87

20. Prediction of Averaged % S.R.E. from Runs 6 and 7 Using Developed Equation for Runs 8 and 9 94

21. Effect of Aragonite on % S.R.E. 96

22. Effect on Injecting Various Sulphur Compounds into the Gasifier Bed 98

23. Effect of Position of Bottom Fuel Injector on % S.R.E. 100

24. Operating Conditions for Period 10-1630 to 13-0030 for Run 9 102

25. Stone Inventory for Gasification Period 10-1630 to 13-0030 for Run 9 103

26. Comparison of Analytical Results from Spark-Source Mass Spectrometry and Neutron Activation Analysis 105

27. Mass Balances for Gasification Period 10-1630 to 13-0030 106

28. Comparison of Trace Element Enrichment Factors on Gasifier Bed Material and Boiler Cyclone Fines 108

I INTRODUCTION

GENERAL

The Chemically Active Fluid Bed process is a means of avoiding sulphur oxide pollution while using heavy fuel oil for production of power. The process uses a fluidised bed of lime particles to convert the oil into a hot, low sulphur gas ready for combustion in an adjacent boiler. Sulphur from the fuel is absorbed by the lime which can be regenerated for reuse. During lime regeneration the sulphur is liberated as a concentrated stream of SO_2 which may be converted to acid or elemental sulphur.

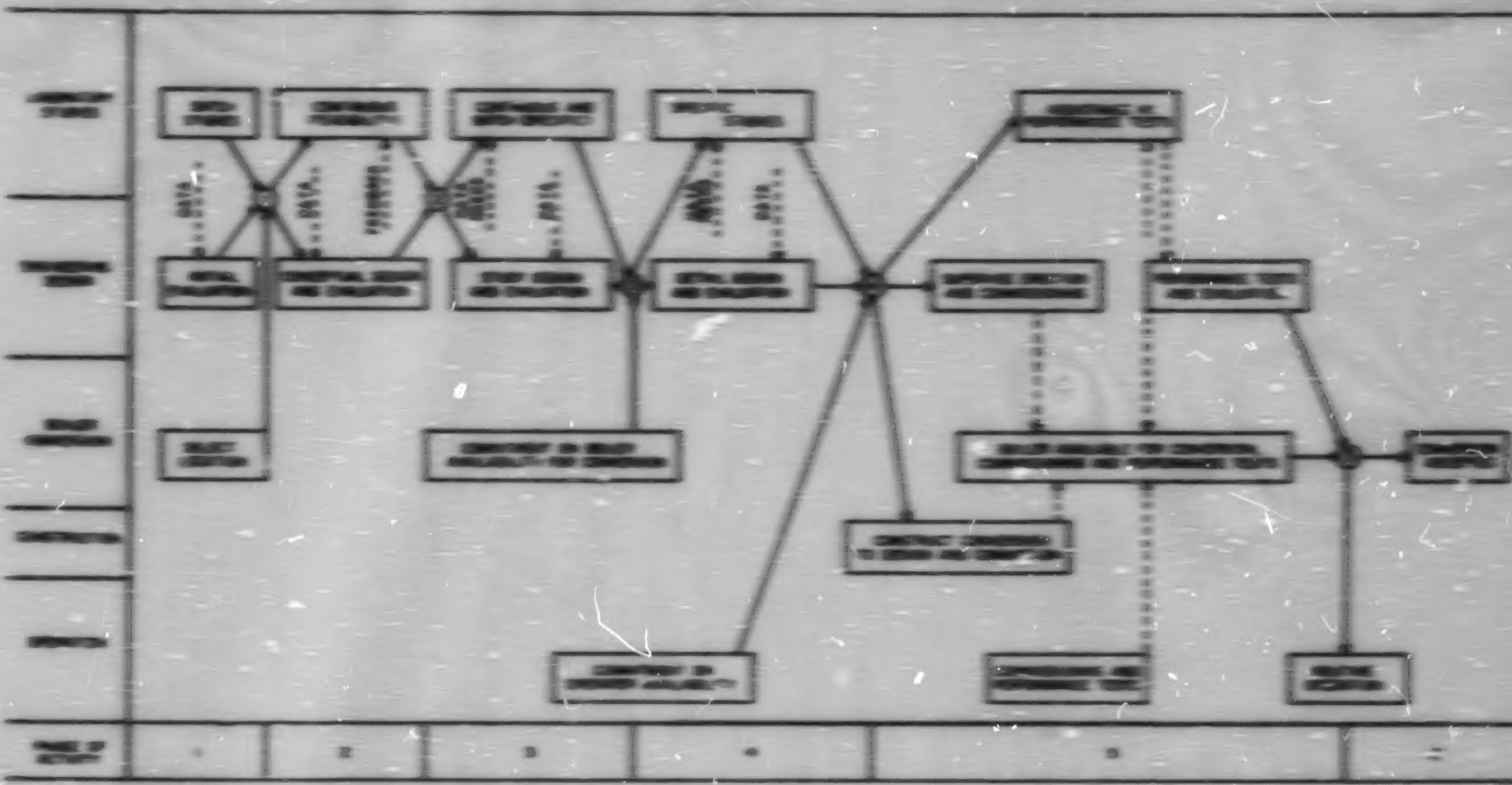
Exploratory work on the CAFB began at the Esso Research Centre, Abingdon (ERCA) in 1968. In 1969 a six-phase programme of work was prepared to take the CAFB process from the laboratory stage through to a demonstration of the process on a 50 to 100 megawatt (electrical) power generation boiler located in the United States. A summary of this six phase programme is shown in Figure 1. Phase I studies at Esso Research Centre were funded under Contract CPA 70-46 in June 1970, and consisted of batch reactor fuel and limestone screening studies, a variable study with U.K. limestone BCR 1691, and initial operation of a pilot plant incorporating continuous gasification and regeneration. The results of these studies were described in the final report (1) for that contract, dated June 1972.

Work on the second phase of studies was carried out in the period July 1, 1972 through May, 1974, and the final report was issued in November 1974 (2).

This report covers work on phase three studies carried out under contract 68-02-1359 between November 1973 and June 1975.

GASIFIER CHEMISTRY

When heavy fuel oil is injected into a bed of fluidised lime under reducing conditions at about 900 deg. C, it vaporises, cracks, and forms a series of compounds ranging from H_2 and CH_4 through heavy hydrocarbons to coke. The sulphur contained in the oil forms compounds such as H_2S, COS and CS_2



with H_2S predominating. The sulphur compounds react with CaO to form CaS and gaseous oxides.

For example:

$$CaO + H_2S \longrightarrow CaS + H_2O$$

The equilibrium for this reaction is far to the right. With a fuel containing 4% sulphur the equilibrium permits a desulphurizing efficiency greater than 90% up to 1100 deg. C. Other factors however limit gasification temperature to the range of about 850 to 900 deg. C where the equilibrium sulphur removal would be about 95% (see Reference 1).

In the shallow fluidized bed of the gasifier there is a rapid circulation of lime between top and bottom. Indications are that coke is laid down on the lime in the upper portion of the fluid bed by oil cracking and coking reactions and that this coke burns off in the lower portion where oxygen is supplied by the air distributor.

Gasification conditions of temperature and air-fuel ratio must be chosen to maintain a balance between the rate of coke and carbon deposition and the rate of carbon burnoff. Broadly, this balance is met at gasification temperatures in the range of 850 to 900 deg. C and air-fuel ratios around 20% of stoichiometric. Lower air fuel ratios are operable at the upper end of the temperature range, and higher air-fuel ratios are needed as temperature is reduced.

Much of the oxygen entering the gasifier is consumed in oxidizing coke to CO and CO_2 near the distributor. Of course, some enters other regions of the bed where it reacts with H_2 and hydrocarbons to form water and more carbon oxides. The final product from the gasifier is a hot combustible gas containing H_2, hydrocarbons, CO, CO_2, H_2O, and N_2. Most of the energy released by partial combustion of the fuel is retained by this gas as sensible heat.

Only a portion of the CaO in the lime is reacted on each pass of solids through the gasifier. Good sulphur absorption reactivity has been obtained with up to 20% of calcium reacted in single cycle batch reactor tests, but in the continuous unit, the average extent of calcium conversion to sulphide is held to less than 10%.

When a single batch of lime is cycled between gasification and regeneration conditions it gradually loses activity for sulphur absorption. The activity of the bed can be maintained if some of the lime is purged each cycle and replaced by fresh material. Reactivity of the bed is therefore a function of the lime replacement rate. The replacement lime is usually added to the gasifier as limestone which calcines in situ.

Vanadium from the fuel oil deposits on the lime during gasification. Experimental evidence is that practically all of the fuel vanadium can remain fixed with the lime.

REGENERATOR CHEMISTRY

Calcium sulphide is regenerated to Calcium oxide by air oxidation.

$$CaS + 3/2\ O_2 \xrightarrow{\qquad\qquad} CaO + SO_2$$

$$\Delta H = -485.1\ kJ/mol$$

A competing reaction also consumes oxygen and forms calcium sulphate.

$$CaS + 2O_2 \xrightarrow{\qquad\qquad} CaSO_4$$

$$\Delta H = -921.3\ kJ/mol$$

Both reactions are strongly exothermic. A third reaction between the solid species is also possible.

$$CaS + 3CaSO_4 \xrightarrow{\qquad\qquad} 4CaO + 4SO_2$$

$$\Delta H = 926.8\ kJ/mol$$

This reaction is strongly endothermic.

The equilibrium constants (Appendix A, Reference 1) for these reactions determine the maximum partial pressure of SO_2 which can exist in equilibrium with mixtures of CaS, CaO, and $CaSO_4$ at any given temperature. These equilibria also determine a relationship between regenerator temperature and the maximum theoretical selectivity of oxidation of CaS and CaO.

At low oxidation temperature, the equilibrium SO_2 partial pressure is too low to permit all the oxygen supplied to leave in the form of SO_2. The excess oxygen then goes to form $CaSO_4$. Experimental oxidation selectivities are lower than the theoretical maximum, probably because of contacting and kinetic factors.

Since each sulphided lime particle passes through a range of temperatures and oxygen concentrations during its transit through the regenerator, it is exposed, on average, to less favourable selectivity conditions than those at the top of the bed.

Calcium sulphide oxidation selectivities to CaO of 70 to 80% and regenerator SO_2 concentrations of 8 to 10% have been achieved in pilot plant operations at regenerator temperatures in the range of 1040 to 1070 deg. C.

During the conversion of CaS to CaO and $CaSO_4$ there is evidence for existence of a transient liquid state (Reference 17). If air is passed through a hot static bed containing CaS, some of the particles will agglomerate into lumps during the regeneration reaction. Agglomeration does not occur if the bed is vigorously fluidised.

BACKGROUND INFLUENCES ON EXPERIMENTAL STUDIES

Details of the results of previous studies are described fully in previous reports (1) (2), but in summary this work had confirmed that good desulphurisation results could be obtained and that the process was stable and controllable. Sufficient information was generated by these studies to enable EPA to request Westinghouse Research Laboratories (WRL), under contract to EPA, to carry out a preliminary technical and cost review and to recommend on future development. A report by WRL (3) confirmed that the CAFB process was attractive when compared with the main alternatives for Clean Power Generation - Flue Gas Desulphurisation or combustion of Heavy Fuel Oil desulphurised at a refinery.

Acting on behalf of EPA, WRL presented the CAFB process to a number of utilities, with the objective of interesting one of them in participating under EPA support in conversion to CAFB operation of a power generation boiler of about 50 MWe capacity. Early in 1973 New England Electric System (NEES) of Westborough, Mass. agreed in principle to cooperate in such a demonstration to be based on a 50 MWe boiler at Providence, Rhode Island. EPA, NEES and WRL jointly selected Stone & Webster Engineering Corporation (SWEC) as the Architect Engineer for the conversion. Details of the SWEC design and costing have been reported by WRL (4), but events were overtaken by the decision of the Federal Energy Authority to schedule NEES boilers for operation on coal only. In view of this, NEES withdrew from the demonstration programme in April 1975.

Fortunately for the progressive continuation of the CAFB development programme Foster Wheeler Energy Corporation (FWEC) had been pursuing an independent programme as a worldwide licensee of patents held on the CAFB process by Esso Research and Engineering Company (ER&E) and drew this to the attention of EPA in April 1975. Agreement was readily reached between EPA and FWEC to fund engineering studies, and FWEC in turn signed an agreement with Central Power and Light (CP&L) of Corpus Christi, Texas, to convert a 30 MWe boiler in the CP&L plant at San Benito, Texas. This programme is now continuing, with plans to construct the demonstration unit during 1976, with a June 1977 startup to commissioning and the test programme.

As set out in Figure 1, Phase Three was planned as a period for supporting design studies and evaluations of the CAFB process. In the event the total EPA programme on CAFB moved rapidly during this period through evaluation to actual design details for the demonstration plant. Consequently the programme carried out by ERCA changed emphasis several times during Phase Three, the contract tasks were modified, and in November 1974 the programme was extended by starting Phase Four in parallel, under EPA Contract 68-02-1474. The latter contract is still in progress, and is due for completion in December 1976.

WORK OBJECTIVES

The final list of tasks adopted for this contract is set out below:-

Task 1	A batch reactor study of up to three limestones which could be supplied to the demonstration plant, plus one alternative fuel oil.
Task 2	The derivation of a model to describe the behaviour and performance of the CAFB process, based on data obtained in previous contracts, to serve as a guide for the engineering design team working on the design of the demonstration plant.
Task 3	A run totalling 270 hours of gasification on the continuous CAFB pilot plant, under conditions indicated by previous studies, and using a fuel oil and limestone combination indicated by earlier work as being suitable for the demonstration plant.

Task 4 A second run of 270 hours under conditions required to provide specific data for design, or to solve problems encountered in Task 3, or to test an alternative limestone.

Task 5 Provide on-going advice and consulation to other contractors engaged in progressing the CAFB demonstration unit.

Task 6 Test materials of construction for their suitability in CAFB by exposing coupons or fabricated parts in selected positions during a CAFB pilot plant run.

Task 7 Determine to what extent CAFB retains on the bed certain elements present in fuel oil and which are potentially harmful when emitted into the air in flue gases.

Task 8 Determine the feasibility of burner design modification to allow on-stream gas duct decoking by reverse air flow, isolation of the gasifier from the boiler furnace and firing the boiler with an alternate clean fuel.

Task 9 Evaluate alternate low cost methods for purge stone and regenerator off-gas disposal.

Task 8 was added to test the principle of an invention made by ERCA under the contract whereby decoking of the gasifier ducts and cyclones could be carried out without shutting down the gasifier or boiler.

Task 9 was added to provide information on the probability of success of the route proposed by WRL for simultaneously converting spent lime and the SO_2 effluent from the regenerator to an innocuous solid. This was the process step included in the SWEC design specifications for costing purposes. As a backup tests were also carried out under Task 9 to evaluate means for inerting spent lime by deadburning, to support an alternative process route of converting the SO_2 effluent steam into elemental sulphur. This is in fact the route now being pursued by FWEC using their proprietary Resox process.

REPORTING AND DISCUSSION OF RESULTS

The discussion is set out in Section V by task and in chronological order, so that reasons for modifications to the programme can be readily discerned. Wherever necessary for additional clarity, reference is made to significant events external to this contract which are summarised above, and which influenced the direction or emphasis of the experimental programme.

II SUMMARY

Phase three of studies on the CAFB process for desulphurising gasification of heavy fuel oil in a fluidised bed of hot lime was carried out between November 1973 and June 1975. Objectives of the work were changed during this period due to changes in the location of the proposed 50 MWe demonstration from New England to Texas, and in the engineering philosophy of some features of the design. Specifically, there was a change from an intention to use spent lime sulphation as the route to disposal of both SO_2 from the regenerator and spent lime from the reactors to a process involving reduction of regenerator SO_2 to elemental sulphur combined with marketing of spent lime, or alternatively dead burning of spent lime for landfill or other disposal.

Tests of candidate limestones confirmed the superiority of BCR 1359 in its resistance to dust production, but showed that several limestones and one dolomite could absorb sulphur just as effectively as BCR 1359.

Sophisticated computer analysis of data generated in phase two and phase three studies identified hitherto unrecognised significant variables, and pointed to areas of potentially profitable further study. Runs 7, 8 and 9 can now be described very effectively by a polynomial expression, but Run 6 gave results consistently better than the predictive equation, and thus offers potential for identification of another significant variable.

As a result of the computer analysis it is now clear that some variables have a fairly large effect, water being by far the most potent (and deleterious), while others, especially stone replacement rate, previously thought to be of major importance, are now seen to be relatively minor contributors.

Operability of the CAFB process was improved by demonstration of decoking of gas ducts and cyclones over a bed slumped from the gasifying mode. No harmful reaction of the hot bed, containing calcium sulphide, and coated with carbonaceous deposits, was observed - especially there was no agglomeration to hinder refluidisation. On stream decoking trials were unsuccessful, and an improved fines return system from the cyclones continued to give trouble.

Retention of a wide range of elements by the lime bed was demonstrated, and in particular retention of alkali metals, which will be of significance to use of a pressurized CAFB for gas turbines, which is currently being evaluated under EPA Contract 68-02-2115.

A prototype burn-back burner demonstrated the suitability of this approach to on-line decoking of gasifiers equipped with parallel cyclones, ducts and burners, the potential for a wide range of turn down, and potential for dual-fuel or standby operation during gasifier outage.

Tests of sulphation of spent lime on a fluidised bed failed to meet the technical objectives set, and this route to SO_2 and lime disposal does not seem viable. Weathering tests on deadburned lime samples showed promise for this technique as an acceptable means of treating spent lime before dumping.

III CONCLUSIONS

TASK 1

1. The three stones which were tested were all inferior to B.C.R. 1359 in respect of dust production and were in fact comparable with B.C.R. 1691 from this point of view.

2. Both the Tymochtee dolomite and the Aragonite were marginally inferior to B.C.R. 1359 in desulphurising performance during cyclic tests.

3. The vacuum bottoms fuel was desulphurised just as effectively as the normal Amuay residual fuel oil despite its higher sulphur content.

TASK 2

The application of a sophisticated computerised regression analysis technique, involving the use of polynomial functions, has enabled the desulphurisation results for Runs 7, 8 and 9 to be harmonised, and individual results to be predicted in terms of the following variables

Bed Depth
Bed Temperature
Air/fuel Ratio
Cyclone Temperature
Ca/S Mol Ratio
Added Water

The results for Run 6 are significantly better than would be predicted by the use of the regression equation, but nevertheless this approach looks very promising and will be further tested and refined in future runs.

Whilst this type of equation is purely empirical, for practical purposes it can serve almost as well as an equation based on a detailed physico-chemical model of the process, and its precision and scope may be improved as more data become available.

However, caution must be exercised in interpretation of future tests on this pilot plant, or on other CAFB gasifiers, in that other variables may then become of importance, or in that operating requirements may be extended outside the range studied so far.

TASKS 3 & 4

Two sets of conclusions may be drawn from an analysis of the operating experience gained during Runs 8 and 9. One set relates to the effects of process variables on Sulphur Removal Efficiency, the other set relates to factors affecting the general operability of the gasifier.

The Effects of Process Variables

1. Contrary to expectations the very much deeper gasifier beds used in Runs 8 and 9 did not give S.R.E.s which were appreciably better than those obtained during Runs 6 and 7. The mean values of S.R.E. and bed depth for the four runs are shown in Table 1.

Table 1

Mean values of S.R.E. and Bed Depth

Run No.	Mean bed depth cms	Mean S.R.E %
6	52	77.5
7	57	75.4
8	91	77.1
9	103	79.1

Although analysis of the test results for Runs 8 and 9 showed that within these runs there was a bed depth effect, it is evident that there were other factors which had an overriding effect between runs.

As mentioned previously this apparent anomaly could be accounted for in the case of Run 7 by the effects of the other five apparently relevant variables, the main factor being the absence of water in Run 7 due to the very limited use which was made of flue-gas recycle during this run. In Run 6 however a very considerable amount of flue-gas recycle was used and the regression equation gave results indicating that the observed S.R.E.s were about 14 percentage points better than they should have been. This suggests that there must have been a factor operating in

Run 8, which is not taken into account in the regression equation and which had an advantageous effect large enough to offset the water debit. It would clearly be advantageous to identify this factor if possible.

2. The mean bed sulphur contents during Runs 8 and 9 were very similar and the standard deviations were small in both cases, consequently no sulphur term appeared in the regression equation. The effect of bed sulphur content on residual error is shown in Fig. 35 and is not as simple as was indicated by the results of Runs 6 and 7.

At bed sulphur contents of up to 6.5% by wt. the range covered in Runs 6 and 7, the plotted points indicate a downward trend for S.R.E. as the bed sulphur content rises. At sulphur contents greater than 6.5% by weight however there appears instead to be an upwards trend in S.R.E. as the sulphur content of the bed material increases and a much greater scatter of results. It is difficult to account for this anomalous trend but it is worth remarking that many of those high sulphur contents were obtained during periods of operation when the carbon content of the gasifier was high enough to render the regenerator inoperative, the tail gas containing CO_2 and CO but virtually no SO_2. It seems likely that there is a combined effect of sulphur and carbon on S.R.E. in which the presence of carbon will up to a point improve sulphur retention in the gasifier by preventing the oxidation of CaS near the distributor. At excessive carbon levels however the S.R.E. would appear to be reduced as shown in Fig. 37. These two conflicting effects might account for the scatter of points in Fig. 35 at bed sulphur levels in excess of 6.5% by wt.

3. Within the temperature range 863-933°C the effect of variations in gasifier bed temperature on S.R.E. during Runs 8 and 9 was small, as can be seen in Fig. 29. This is in line with previous findings but there are indications of an optimum temperature in the range of 880-900°C. As the bed temperature is increased above 930°C there is a rapid decline in S.R.E., though even at 980°C a substantial proportion of the sulphur entering the bed is retained.

4. The range of air/fuel ratios explored during Runs 8 and 9 was much wider than was the case for Runs 6 and 7 and, as can be seen in Fig. 30 there are indications that leaner operation resulted in improved desulphurisation efficiency. Unfortunately it is not entirely clear whether this effect was in fact directly related to stoichiometric ratio or whether it arose from the corresponding variation in sulphur throughput, since most of the variation in stoichiometric ratio was obtained by varying the fuel rate.

5. The relationship between S.R.E. and Ca/S molar feed rate for Runs 8 and 9 is shown in Fig. 33. The information presented here confirms the findings from the results of Runs 6 and 7 which indicated that stone replacement rate has a relatively minor effect on S.R.E. According to Fig. 33 there is on average only a 3 percentage points improvement in S.R.E. for an increase in stone consumption from 0.5 mole to 1.3 mole. This indicates the desirability of investigating stone feed rates of less than 0.5 mole. It would indeed be desirable to operate the unit at the minimum stone feed rate which will allow the bed depth to be maintained constant, because this will minimise the production of fines due to calcination and might in time result in virtually dust-free operation.

6. It has been found that an operating variable having an appreciable effect on S.R.E. is the rate of bed circulation through the gasifier cyclones. A rough indication of this circulation rate during Runs 8 and 9 was given by the mean temperatures of the cyclone fines drain vessels. In Fig. 31 these temperatures have been used as the appropriate variable and over the range observed the apparent effect on % S.R.E. is about 7 percentage points. There are several possible explanations for this effect, the simplest of which is that the fines recycle rate indicates the extent to which lime particles are present in the free-board.

7. Although fines recycle rate is a function of bed particle size, there is no evidence of a relationship between bed particle size and S.R.E., as can be seen in Fig. 34. This suggests that the effect of bed material size is fully accounted for in the cyclone temperature term.

8. As mentioned previously the presence of water had a marked adverse effect on S.R.E. as is shown in Fig. 32. During most of the tests the water debit was relatively small but the indications are that if sufficient water is present it can virtually deactivate the sulphur absorbing capacity of the bed.

Operating Factors

1. During Run 9 attempts were made to reduce the rate of carbon deposition in the cyclones by introducing air and steam under the lid of the gasifier. These attempts were not successful.

2. It has been established that the carbon burn-out procedure may be carried out successfully over the slumped gasifier bed without prior sulphation. This procedure was employed several times and each time the gasifier was put back on stream without any problems. There was nothing to indicate the formation of a surface crust due to oxidation of the calcium sulphide in the surface layer of the bed and it seems that the small bleed of nitrogen which was passed through the slumped bed was sufficient to prevent the oxygen from diffusing to this region.

3. During both Run 8 and Run 9 a considerable amount of trouble was experienced with the cyclone fines re-injection system. It must be concluded that the Sturtevant solids pump is unsuitable for this purpose because the use of high gas pressures for solids transfer causes high cyclone losses when the isolating valves fail to seat properly.

TASK 7

It has previously been established that the gasifier bed material retains the bulk of the heavy metals in the fuel. The more detailed analytical work carried out on samples collected during Run 9 established that virtually all of the sodium and potassium in the fuel is also recovered. Previous results based on analysis of the gasifier bed material indicated that only about 30% of the sodium was retained, but thw complete analysis showed that the rest of the sodium was recovered with the fines drained from the boiler cyclone. It seems therefore that the volatile alkalis are trapped outside the gasifier at low temperature regions within the boiler. This suggests that, if the gas is suitably quenched, alkalis will not present a problem when a fluidized bed gasifier is used to fire a gas turbine.

TASK 8

Tests made with the model burn-back burner showed that this type of burner configuration, in which air is admitted through a central duct and gas is introduced into a conical casing, gives a very stable flame and a good turn-down ratio. The burn-back principle was also successfully demonstrated.

TASK 9

1. It does not appear to be feasible to achieve more than 80% sulphation of spent lime in a fluidised bed reactor, consequently dry sulphation is not a very attractive route for the disposal of the regenerator SO_2 stream.

2. Dead burning of lime at temperatures of 1350°C or greater reduces reactivity to water considerably, but the initial reaction process is still hydration. The hydrated lime is converted to calcium carbonate with little loss of calcium from the exposed sample, even with monthly mixing of the reacted crust with the bulk sample. Thus this technique seems promising as a procedure for treating spent lime prior to dumping on land.

IV RECOMMENDATIONS

1. Since the presence of water, both in the fuel and in the recycled flue gas appears to have an adverse effect on sulphur removal efficiency, it is recommended that the flue gas recycle scrubber of the gasifier be eliminated. There are two ways in which this may be done

   1. The wet scrubber may be replaced by a bag filter.
   2. The unfiltered flue gas recycle stream may be introduced into the gasifier bed via a large bore tuyere situated above the distributor, instead of being ducted into the plenum and passing through the distributor.

The second alternative is preferable, but provision should be made to test both alternatives.

2. It has been demonstrated that reasonably good desulphurisation is obtainable at stone replacement rates of less than half the Ca/S molar ratio. There is an incentive, in terms of dust control, to investigate the minimum stone make-up rates which will maintain constant bed depths under various operating conditions. Very low stone replacement rates will also ease the stone procurement problem and may allow the recovery of heavy metals from the spent stone.

3. The effects of both stone sulphur content and stone carbon content on S.R.E. are still in need of clarification and should be examined in more detail.

4. The cyclone fines drain and return system used in Runs 8 and 9 was unsatisfactory and should be replaced by a simpler system preferably without moving parts.

5. Attempts to control carbon deposition in the cyclones by air and steam injection have been unsuccessful, therefore the use of small but heavy and abrasive particles should be considered. Silicon carbide particles were used in the sulphation work carried out in Task 9 in an attempt to grind the softer lime particles in a fluidised bed, but no such effect occurred. It should therefore be possible to scour the cyclones without creating a dust problem by using silicon carbide particles which are small enough to reach the cyclones but large enough to be retained by them.

6. The design of the existing gasifier will not allow major modifications to be made either to the configuration of the cyclones or to the cyclone drainage system. It is therefore recommended that the gasifier be replaced prior to Run 10 by a new unit in which the cyclones are replaceable and are mounted so as to allow a simple fines drainage and return system to be used.

7. Consideration should be given to the problem of injecting fuel uniformly into a large scale unit and the new gasifier should incorporate provision for testing suitable injector designs.

V DISCUSSION

BATCH STUDIES

Equipment and Method of Operation -

The initial objectives of Task 1 were to check on a batch reactor three limestones and one alternative heavy fuel oil which might be used in the proposed 30 M.W.e. demonstration plant.

The batch reactors have been described previously and so have the test procedures used for measuring dust cyclic tests (2). The tests carried out under task 1 were of a comparative nature, the reference materials being Amuay residual fuel oil and B.C.R. 1359 stone.

Fuels and Limestones - The alternative fuel which was selected was an Amuay vacuum bottoms stream and details of its composition and inspection data are shown in Table 1 together with those for the reference fuel.

TABLE 1

COMPOSITIONS AND PROPERTIES OF FUEL OILS USED IN THE BATCH TEST PROGRAMME

PROPERTY	AMUAY RESIDUAL FUEL OIL	AMUAY VACUUM PIPESTILL BOTTOMS
Specific Gravity	0.957	1.018
Kinematic Viscosity		
Cs at 140°F	201	-
210°F	41.1	3180
300°F	-	321
350°F	-	840
400°F	-	71
Carbon % by wt	85.9	84.7
Hydrogen % by wt	11.3	10.0
Sulphur % by wt	2.3	3.3
Nitrogen % by wt	0.35	0.59
Conradson Carbon % by wt	11.6	17.4
Asphaltene % by wt	7.1	8.9
Vanadium ppm	300	550
Nickel ppm	43	66
Sodium ppm	36	6
Iron ppm	3	3.5

Due to an initial delay in the procurement of suitable limestone samples Tymochtes dolomite, which was already held in store, was substituted for one of the candidate stones. The two candidate stones which were tested were aragonite which consisted of small seashells and a crystalline material designated Conklin stone.

Analyses of these materials are given in Table 3

TABLE 3

CHEMICAL COMPOSITIONS OF LIMESTONES TESTED

STONE COMPONENT		BCR 1359	TYMOCHTES DOLOMITE	ARAGONITE	CONKLIN
CaO	% by wt	54.1	31.1	57.5	39.6
MgO	% by wt	0.6	20.9	0.65	12.0
SiO_2	% by wt	0.75	3.1	<0.2	12.3
Fe_2O_3	% by wt	0.08	0.4	Trace	0.13
Al_2O_3	% by wt	0.31	1.13	0.05	0.53
CO_2	% by wt	44.0	43.6	40.8	36.9
S (total)	% by wt	0.12	0.13	0.17	<0.04
Vanadium	ppm	50	<25	<50	<50
Sodium	ppm	<20	175	2520	<50
Nickel	ppm	30	10	-	53

Experimental results - At a very early stage it was found that the Conklin stone was too prone to decrepitation to be considered for use in the demonstration plant and since no other stone samples were forthcoming only the Tymochtes dolomite and the Aragonite were fully tested. The resources which were released in this way were devoted to the burn-back burner tests which are described later in this section of the report.

The detailed experimental data which were obtained during the dust tests and the cyclic desulphurisation tests are reported in Appendix A. Summaries of the dust results and the cyclic test results are given in Table 4. The results of the first sequence of cyclic gasification tests made with Tymochtee dolomite are not reported in Appendix A because it was subsequently found that the distributor of the batch gasifier had developed a large crack during the course of the test.

Dust results - As can be seen in Table 4 the dolomite and the aragonite were both markedly inferior to B.C.R. 1359 in dust production and under cyclic conditions both were inferior to B.C.R. 1691 which, from pilot plant experience in Run 4 (2) is considered unsuitable for use in a full scale plant. It follows that neither of these stones appears to be a promising candidate for use in a demonstration plant.

TABLE 4

SUMMARY OF BATCH UNIT LOSS RATES

LOSS RATE (g/min)

CONDITIONS	KEROSINE COMBUSTION	FUEL OIL COMBUSTION	FUEL OIL COMBUSTION	GASIFICATION REGENERATION CYCLIC TESTS
Limestone				
Tymochtee Dolomite	5.5	10.5	10.3	6.4
Aragonite	6.6	6.9	6.4	5.0
BCR 1359	7.1	-	3.6	1.9
BCR 1691	22.6	13.5	7.8	4.5

Cyclic desulphurisation test results - Both the aragonite and the dolomite were subjected to cyclic gasification tests, using Amuay residual fuel oil, in order to assess their effectiveness as sulphur absorbers. Additional tests were also run under similar conditions with B.C.R. 1359. The overall results of these tests are summarised in Table 5. It is normal for the results of the first six or seven of a series of cyclic tests to show a falling trend in sulphur removal efficiency towards a stable value. This was observed in the case of the dolomite and the B.C.R. 1359 stone but the aragonite showed a fairly uniform result right through the test series. The values shown in Table 5 were obtained by averaging all but the first eight results in the case of BCR 1359 and Tymochtee dolomite whilst all of the aragonite results were used.

TABLE 5

LINED-OUT S.R.E.'s FOR CANDIDATE STONES

STONE	FUEL	MAKE-UP-RATE x STOIC Ca/S	% SRE
Aragonite	Amuay Resid.	1.10	65
Aragonite	V.P.S.B.	0.91	65
Tymochtee Dolomite	Amuay Resid.	0.44	68
Tymochtee Dolomite	Amuay Resid.	0.86	64
B.C.R. 1359	Amuay Resid.	1.10	68

It is evident that the desulphurising performances of the aragonite and dolomite are not appreciably different from that of BCR 1359. It is also clear that the heavier vacuum pipestill bottoms having a sulphur content 40% higher than that of Amuay residual fuel oil is unlikely to cause any problems. Although the Ca/S make-up rate was lower for dolomite than for the other stones, the actual stone addition rates were comparable. It is however difficult to account for the fact that the higher stone replacement rate gave the poorer performance. It seems likely that both of the candidate stones are marginally less effective than BCR 1359 as sulphur absorbents but are quite acceptable from this point of view. In both cases dust production will be the deciding factor in judging suitability for continuous operation in the demonstration plant.

Burn-back Burner

Introduction -

The objectives of this work were as follows:

- To determine the feasibility of burner design modification to allow:
  - (1) on-stream gasifier gas duct decoking by reverse air flow.
  - (2) isolation of the gasifier from the boiler furnace.
- To provide burner performance data suitable for scaled up tests on a CAFB continuous gasifier.

Equipment and Operating Procedure -

A sectional view of the experimental burner which was used to demonstrate the feasibility of on-stream gasifier gas duct decoking is shown in Figure 2. It will be seen that the primary air is fed to the burner through a central heat resistant pipe which is retractable. The secondary air is fed tangentially into a swirl chamber and emerges from equispaced nozzles near the burner orifice plate. In the normal running position the primary air pipe is retracted and the gas and primary air are able to mix and pass through the orifice into the combustion zone where the secondary air is added.

A design feature of the burner is the movable primary air pipe which would allow isolation of the gasifier from the boiler furnace. When the primary air pipe is advanced, it seals off the concentric gasifier gas duct, which may then be burned out by introducing air into it through the small inlet pipe shown in the drawing. This "burn-out" configuration allows an alternative fuel to be introduced with the primary air whilst the burn-out is in progress, though no provision has been made for this in the present design. During the course of these decokes, whilst maintaining gasification, the gasifier product gas was flared from an alternative outlet and the combustion products of the burn-out flowed back into the gasifier and left via the second burner. A line diagram of the complete apparatus is shown in Figure 3.

REVERSE AIRFLOW DECOKING BURNER

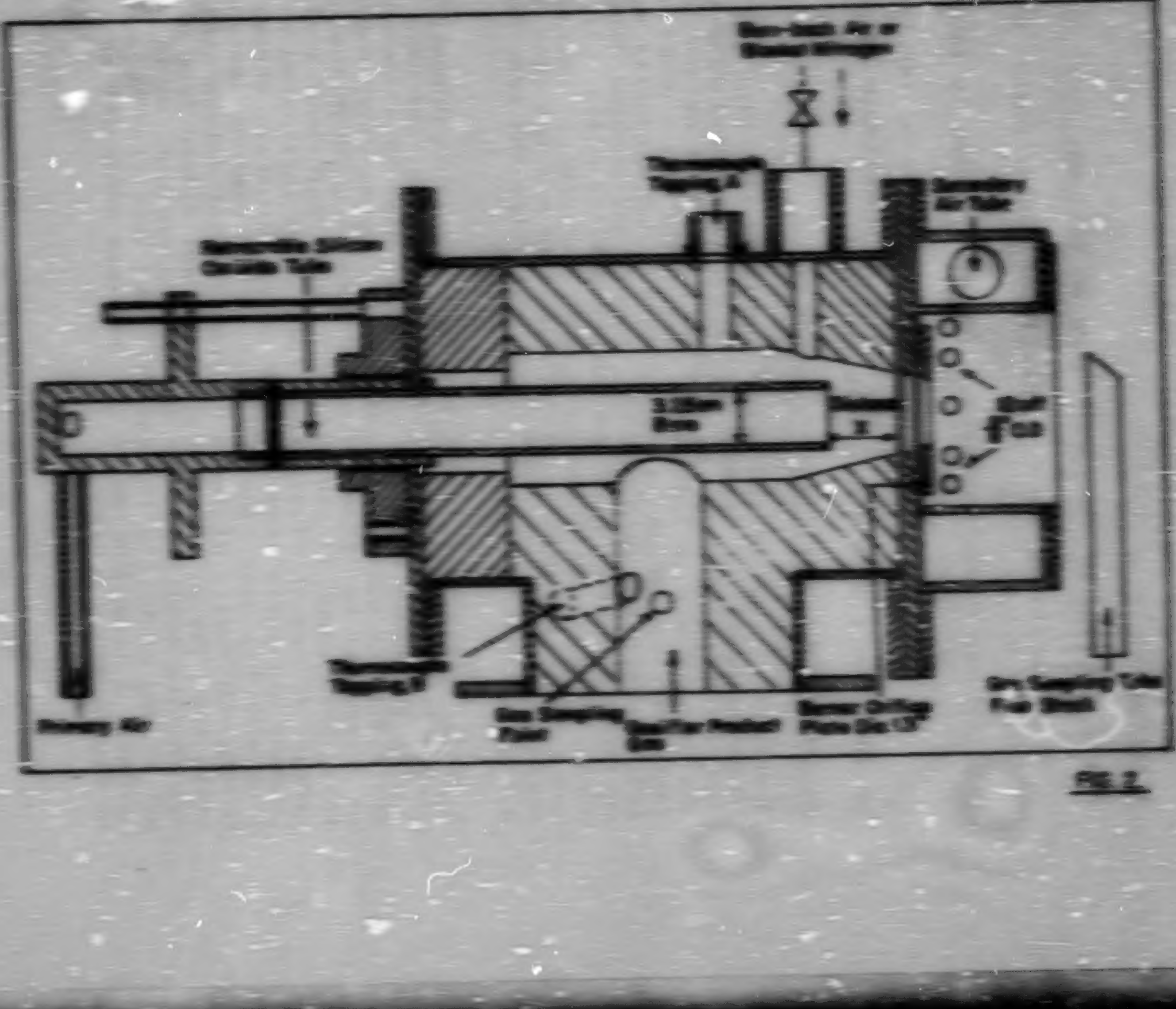


FIG. 2.

LINE DIAGRAM OF BATCH UNIT

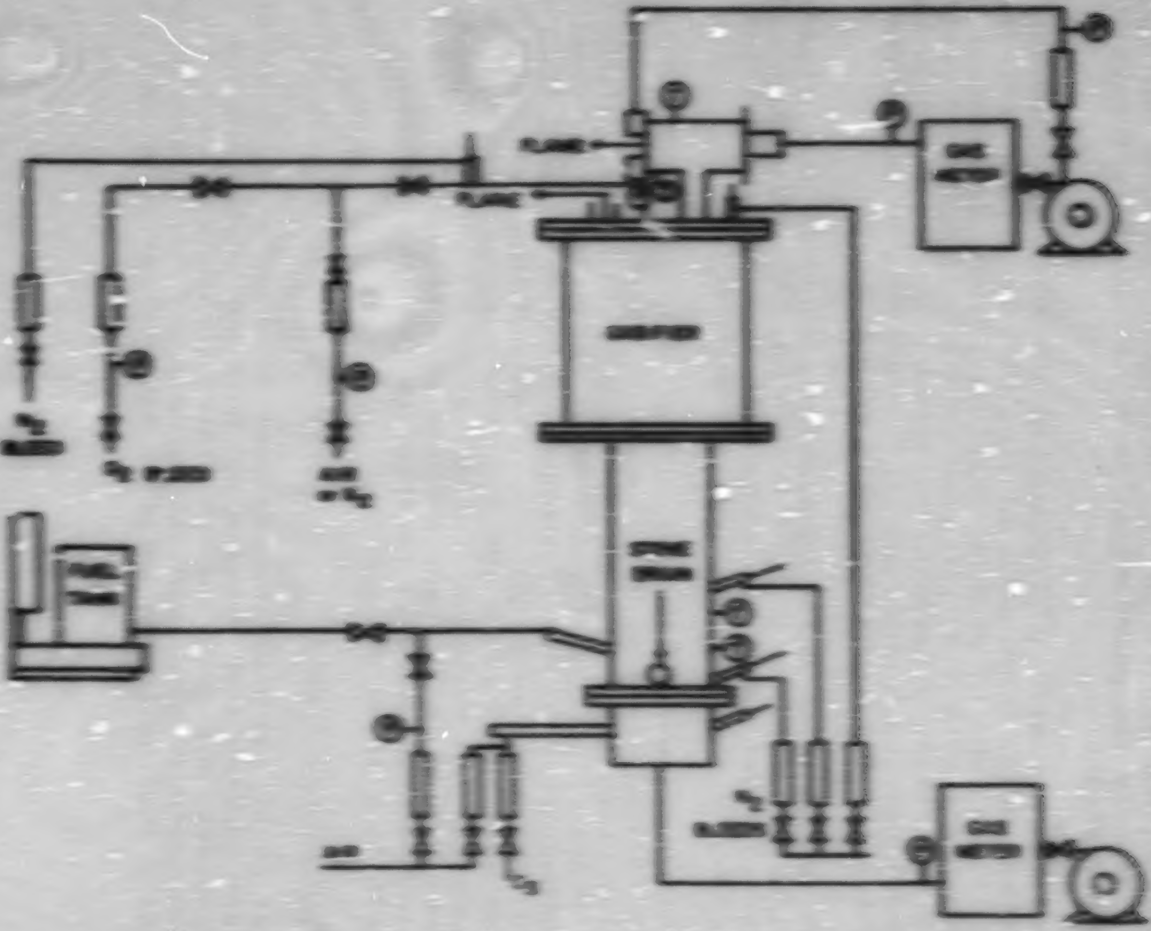


FIG.3.

The existing 4A batch gasifier was used but it was necessary to provide additional items of equipment in order to supply primary, secondary, and burn-out air to the reverse airflow decoking burner. It will be seen that the main fluidisation air and primary burner air were metered by positive displacement meters. Flow-raters were used for the fuel injection air, secondary burner air, burn-out air and oxygen, and the bleeds to the manometers which were used to measure the pressure drops across the burner duct, bed, and distributor.

The batch gasifier was operated under cyclic gasification/regeneration conditions to simulate continuous CAFB gasification and to produce gasifier product gas similar in composition to that produced on a continuous CAFB gasifier. The operating procedures for batch unit cyclic tests have previously been reported (2). Consequently only those additions to the procedures will be noted.

During start-up and regeneration operations the primary air pipe was advanced to seal off the gasifier gas duct and nitrogen was passed into the duct to blanket any laid-down carbon in the duct from contact with air.

The experimental burner flue gas analyses for CO_2, CO, and O_2 were obtained by sampling at an appropriate point in the flue stack and using the existing train of analytical instruments. During the course of an on-stream burn-out the combustion products of the burn-out were metered for CO_2, CO, and O_2 by sampling from a small pipe in the gasifier gas duct shown in Figure 2. Provision was also made for sampling the uncombusted gasifier product gas during the course of a run. These samples were collected in large plastic bags and were analysed by gas chromatography within half an hour of collection.

Burn-back Evidence -

The on-stream gasifier gas duct decokes for which detailed duct surface temperatures and burn-out combustion gas analyses were obtained are listed in Table 6. The duct temperatures were measured by means of two thermocouples A and B located in the gasifier gas duct as shown in Figure 2.

Table 6

Temperature Increases during On-stream Gasifier Gas Duct Burning

Run No.	Reverse Flow Burn-Back Gas Flow l/min.	O_2 vol. %	Burner Temperatures, °C Thermocouple B Initial	Max.	Interval, min	Thermocouple A Initial	Max.	Interval, min
3	63	21	366	454	9	230	325	11
5	45	21	403	493	10	233	268	9
8	52	35	425	566	3	255	372	5
6	126	43	332	583	5	200	442	7
10	134	59	630	716	2	-	-	-
9	180	62	480	685	3	296	450	4
7	113	70	293	490	4	175	360	4
11	100	78	325	558	3	202	415	7
12	125	79	546	638	2	345	462	5

The evidence that successful decokes were achieved is fourfold:

- o Gasifier duct surface temperature trends during a burn-out
- o Burn-out combustion product gas analyses
- o Visual evidence that deposited carbon present just before a burn-out was removed during it
- o Pressure across gasifier gas duct as on-stream measure of duct decoking/coking.

The rise in duct surface temperatures due to the exothermic reaction of carbon and oxygen was observed as expected. The maximum temperatures observed after the noted time interval from the start of the burn-out, when the reverse flow burn-out gas was introduced, are listed in Table 6. When air was used to burn-out, as in Runs 3 and 5, rather small temperature rises were observed as a result of partial burn-out only. Comparison of the photographs in Figures 4 and 6 shows that carbon was only removed from the primary air pipe outer surface in the direct locality of the incoming burn-back air. This poor burn-out performance with air was a consequence of the gas duct temperatures being rather low - in the region of 450°C - to initiate the combustion reaction. This temperature is lower than that anticipated in a large continuous CAFB unit gasifier gas duct. Duct temperatures in the region of 850°C have been observed on the CAFB pilot plant when gasifying normally. With air as the burn-out gas the coke/atmospheric oxygen reaction initiates readily and raises duct temperatures rapidly. The duct temperatures are normally held down in the region of 1200°C by mixing the flue gas with incoming air to control the oxygen concentration in the burn-out gas and thus to prevent damaging the duct by excessively high duct temperatures. In the batch unit tests large heat losses occurred from the gasifier product gas in spite of considerable effort in lagging the gasifier, product gas ducts, and the burners. The introduction of the primary air at ambient temperature also had a cooling effect on the gasifier gas and duct. This cooling is clearly demonstrated by the temperature difference of about 150°C observed between thermocouples A and B. Coking occurred preferentially on the cooled primary air pipe outer surface. For a scaled-up burn-back burner it is recommended that careful attention be paid to the design so that moving surfaces are out of contact with gasifier product gas and that these surfaces are purged with air to minimise coking.

The addition of oxygen to the burn-back air allowed complete burning of deposited carbon to occur in the batch tests. This method was used to increase the rate of decoking because of the low duct temperatures. Oxygen enrichment will certainly not be required when decoking hot product gas ducts on a larger scale gasifier, as described above when oxygen dilution was required for control purposes. The maximum burn-back duct surface temperatures observed in the batch tests were in the region of 600°C and occurred rapidly after introduction of the air/oxygen mixture. Primary air pipe outer surface temperatures were in the region of 1500°C. Comparison of the photographs in Figures 5, 6, 7, 8, and 9 shows that the coke was completely burnt off from the gas duct.

The gasifier product gas produced by the batch gasifier was similar in composition to that produced on the CAFB pilot plant. The product gas was analysed during the course of several runs by gas chromatography. This analysis gives an air -, water -, and liquid hydrocarbon - free basis composition. The results are presented and compared with gasifier gas analyses for continuous gasification pilot plant runs 5 and 8 in Table 7.

The burn-back combustion gas analysis variations during three of the batch test decokes are shown in Figures 10, 11, and 12. The peak CO_2 concentration occurs at the time of maximum O_2 depletion and maximum gasifier duct surface temperatures, as expected for the exothermic combustion of deposited carbon. Burn-out gas analyses and gasifier duct temperatures for all the decokes are listed together with the gasifier operating conditions in Appendix B.

The pressure across the gasifier product gas duct was observed to rise steadily during the course of the gasification runs and drop after a decoke. This method of estimating the rate and degree of gas duct coking and the degree of decoking, both whilst maintaining gasification, was evaluated since it clearly would be of value when operating a multi-burner gasifier with on-stream decoking burners.

The initial pressures across the gasifier gas duct after a decoke are in the region of 0.17 ± 0.1 kilopascals.

COKED-UP PRIMARY AIR PIPE

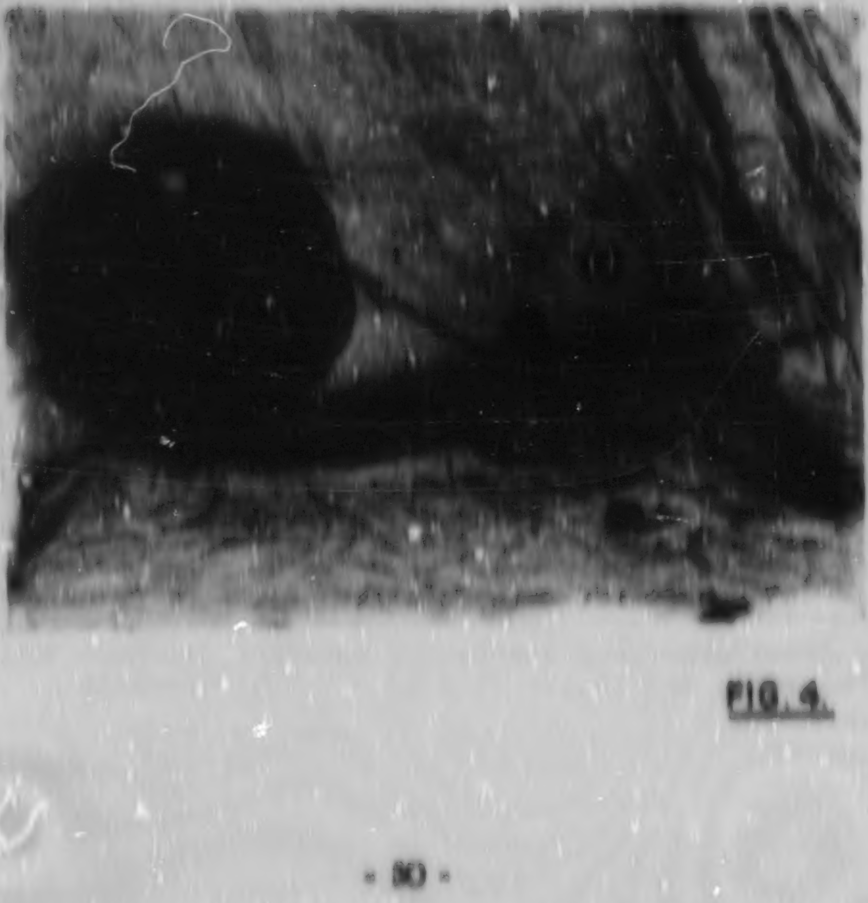


FIG. 4.

COKED-UP GASIFIER GAS DUCT

FIG.5.

PARTIALLY DECOKED PRIMARY AIR PIPE

FIG. 6.

DECOKED GASIFIER GAS DUCT

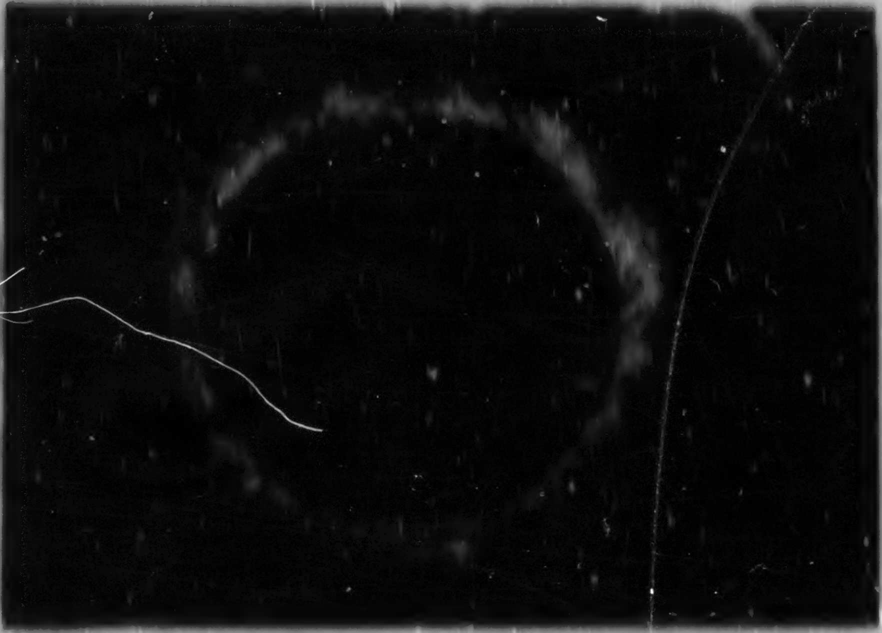


FIG. 7.

DECOKED PRIMARY AIR PIPE

FIG. 8.

DECOKED PRIMARY AIR PIPE
(CLOSE-UP)

FIG. 9.

Table 7

Comparison of Gasifier Product Gas Compositions From Batch and Continuous Units

GASIFIER PRODUCT GAS COMPOSITION, VOL. %	CONTINUOUS UNIT		[illegible]				
	RUN 5	RUN 8	RUN 10	RUN 11	RUN 12	RUN 13	RUN 14
[illegible]	6.7 ± .8	8.6 ± 2.0	7.8 ± .4	8.1 ± .3	7.5 ± .4	8.0 ± .4	8.5 ± .4
[illegible]	63.1 ± 1.3	61 ± 5	74.3 ± .7	68.2 ± .7	69.1 ± .7	67.2 ± .7	65.1 ± .7
[illegible]	6.3 ± .3	6.6 ± 1.0	5.8 ± .3	8.2 ± .4	8.8 ± .4	7.8 ± .4	5.2 ± .3
[illegible]	8.5 ± .8	10 ± 1	6.7 ± .3	6.5 ± .3	6.9 ± .3	5.8 ± .3	11.2 ± .6
[illegible]	10.7 ± .3	9.5 ± 2.0	3.4 ± .2	6.7 ± .3	7.5 ± .3	7.2 ± .3	8.0 ± .3
[illegible]	4.6 ± .7	4.3 ± .6	1.8 ± .1	4.3 ± .2	0.9 ± .1	3.2 ± .2	1.9 ± .1
[illegible]	–	0.12 ± .04	0.08 ± .01	0.05 ± .01	0.03 ± .01	0.05 ± .01	0.12 ± .01

BURN-OUT GAS ANALYSES DURING RUN NO. 3

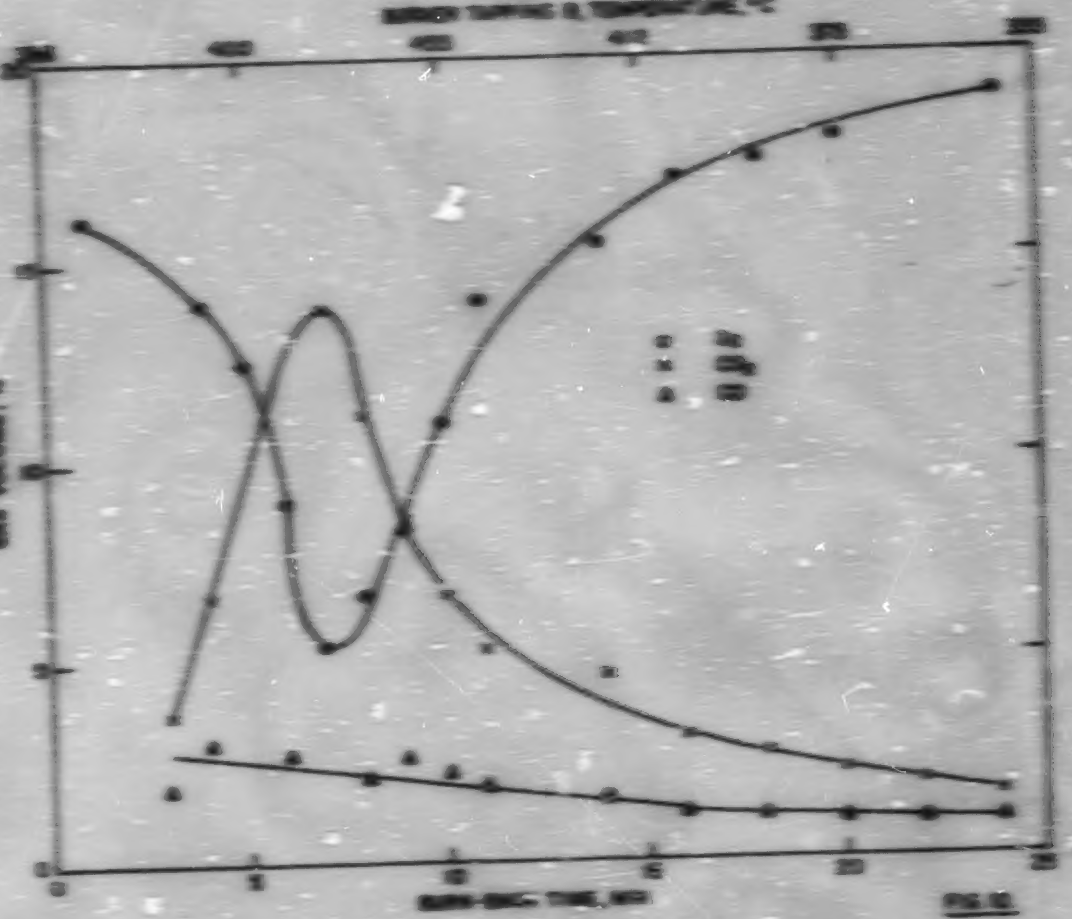


FIG. 10

BURN-OUT GAS ANALYSES DURING RUN [illegible]

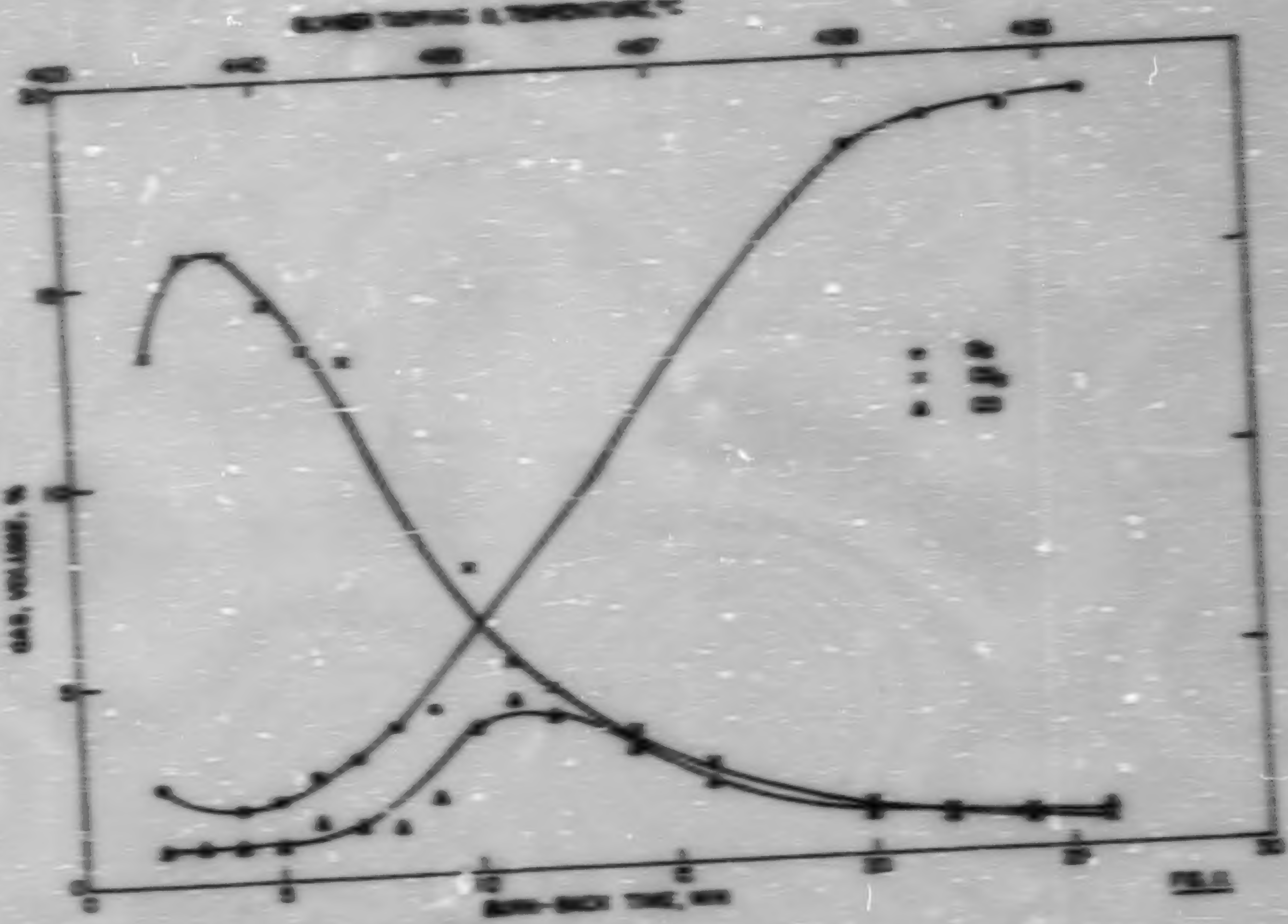


FIG. [illegible]

BURN-OUT GAS ANALYSES DURING RUN NO 7

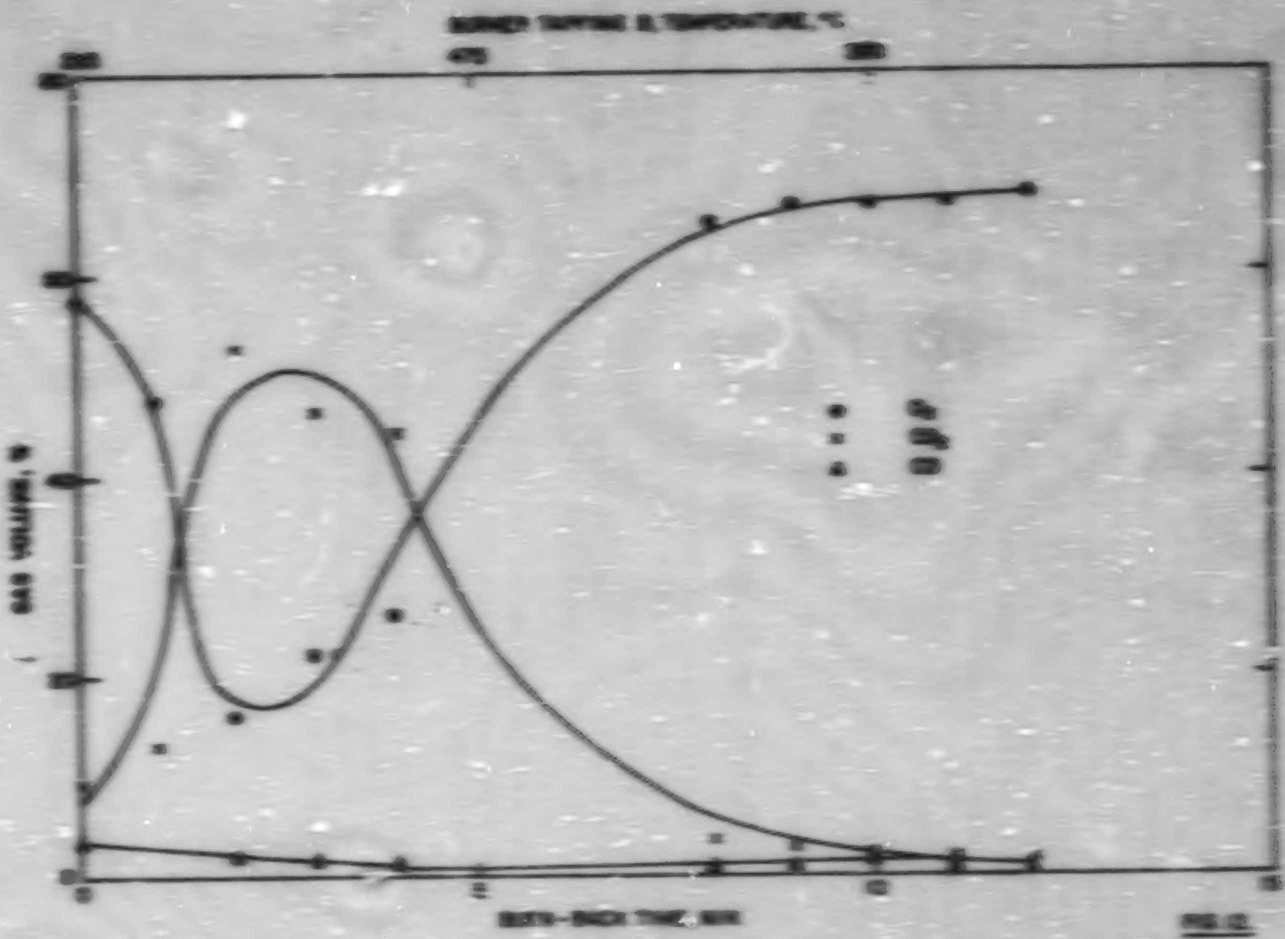


FIG. 12.

The variation of the pressure across the gas duct during the course of the gasification runs is shown in Figure 13. The slope of the plot of this pressure against the cumulative total air to the gasifier bed at constant bed temperature, fuel rate, bed depth, and superficial gas velocity is a measure of the rate of gasifier gas duct coking and is shown in Table 6. The rate and degree of gasifier gas duct coking is dependent mainly on the volume of product gas passing through the gas duct and the composition of the gasifier gas. These two factors themselves are dependent on the gasifier operating conditions. The volume of gasifier gas is proportional to the volume of air supplied to the gasifier bed at constant bed temperature, bed depth, and fuel rate.

The dramatic rise in the rate of gasifier gas duct coking at gasifier bed air/fuel substoichiometric ratios less than about 24% is clearly shown in Figure 14.

Burn-back Burner Performance Data -

It is desirable that low Btu burners should be as compact as possible so that boiler modifications required for retrofits may be minimised. From this point of view the burner configuration shown in Figure 3 looks promising and the following characteristics have been observed:

- Very stable flame which did not lift-off at high combustion intensities nor light-back under low flow conditions.
- Gasifier product gas throat loading turndown range of at least 8:1, where throat loading is the rate of flow of gas/unit area between outer surface of primary air pipe and refractory lining.
- Ignition took place readily.
- Quiet operation on ignition, during burning, and on extinction.
- Complete combustion. Neither carbon nor carbon monoxide escaped from the flame when stoichiometric air or greater was supplied.

PRESSURE ACROSS GASIFIER GAS DUCT AS A MEASURE OF DUCT DECOKING/COKING

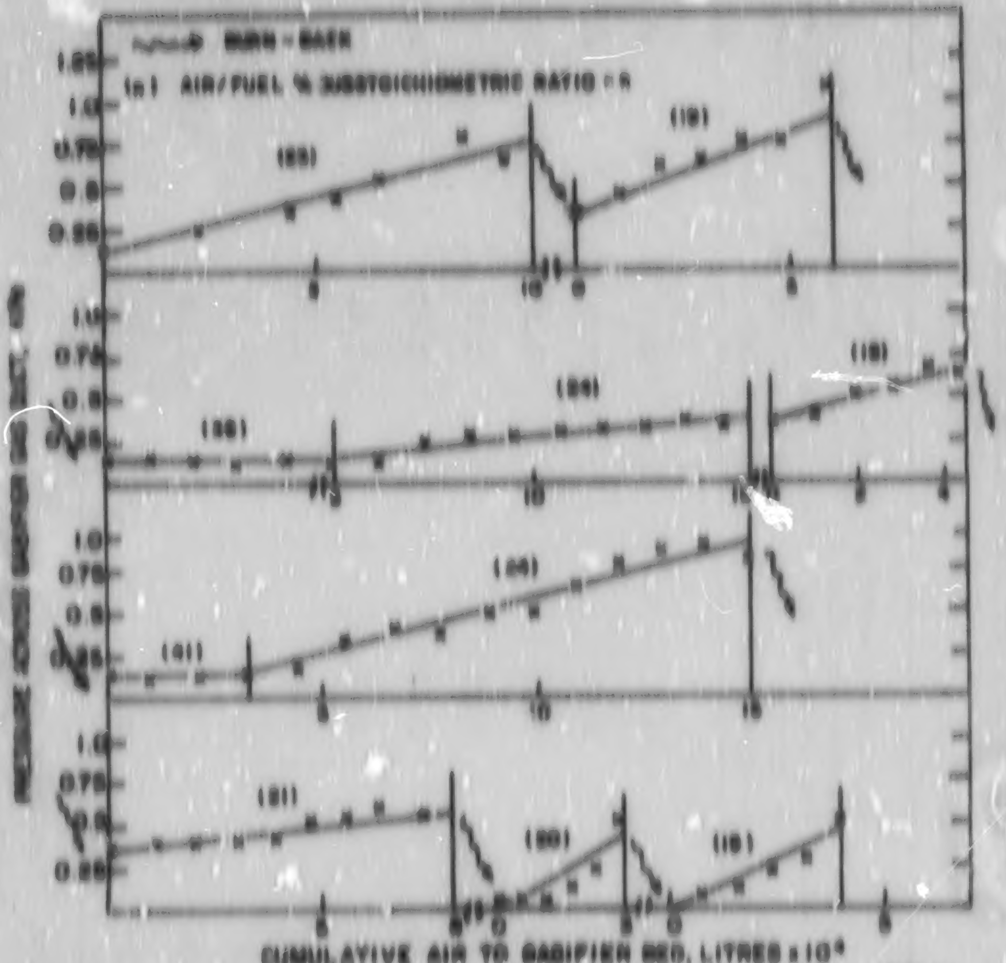


FIG. 4

Table 8

Measure of the Rate of Gasifier Gas Duct Coking

Run No.	Initial Pressure Across Gasifier Gas Duct After A Decoke Kilopascals	Slope of Plot of Pressure Across Gas Duct vs. Cumulative Total Air to Bed Kilopascals/l, x 10^{-5}	Gasifier Bed Air/Fuel Substoich. %
3a	0.15	0	30 ± 3
6a	0.12	0.07	41 ± 3
3b	0.15	0.23	26 ± 2
9	0.35	0.27	21 ± 4
6b	0.12	0.62	24 ± 2
1	0.12	0.63	23 ± 7
5	0.15	0.74	18 ± 2
2	0.32	1.10	19 ± 2
13	-	1.32	13 ± 2
11	0.05	1.52	20 ± 2

Other operating conditions:

Bed Temperature, °C	873 ± 46
Pressure Across Bed, kPa	2.66 ± 0.32
S. Gas Velocity, m/s	1.6 ± .3

VARIATION OF RATE OF GASIFIER GAS DUCT COKING WITH GASIFIER BED AIR/FUEL RATIO

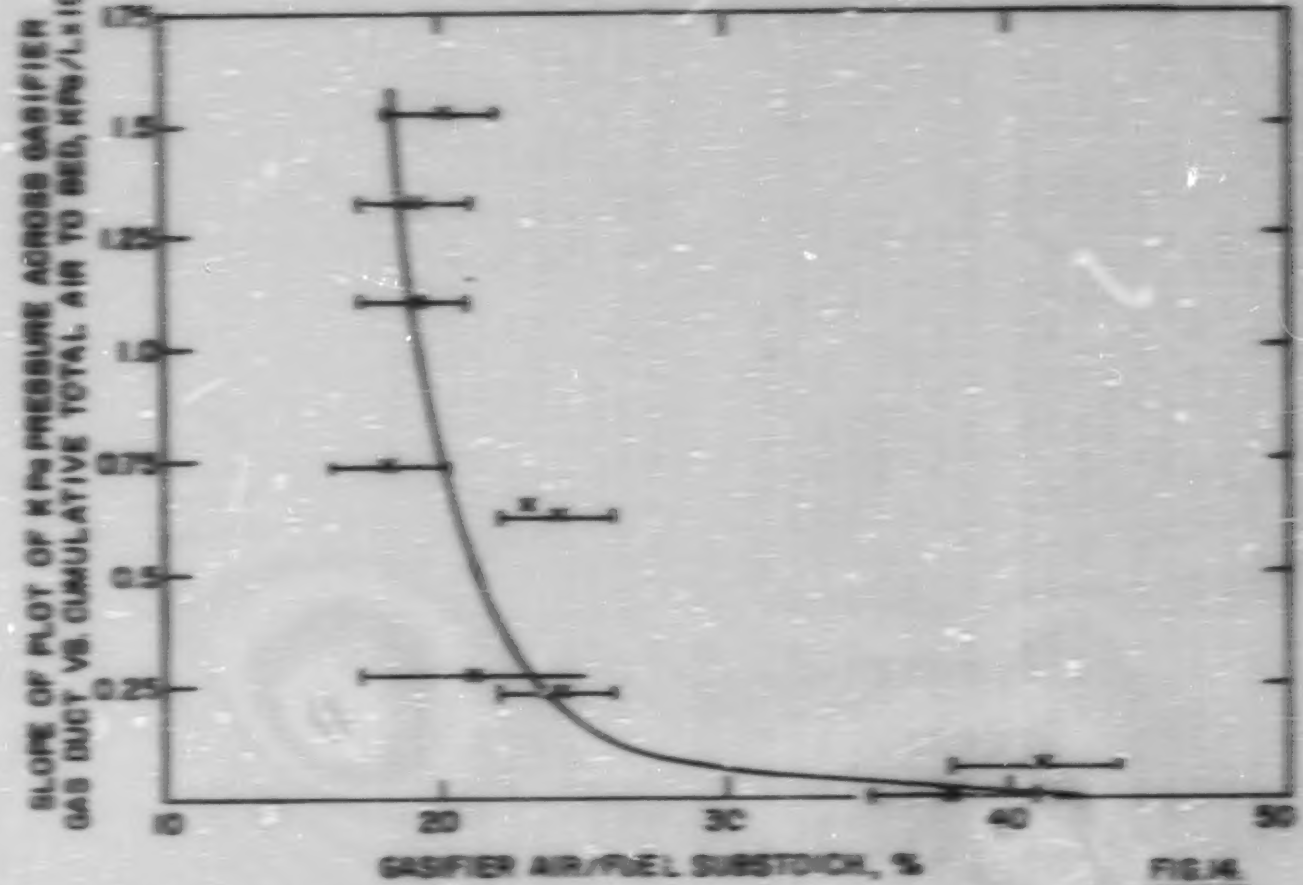


FIG.14.

The normal procedure to determine the limits of flame stability involves variation of the air supply rate at given rates of fuel gas supply (5, 6). In this way the locus of lift-off/flash-back points is used to establish the region of stable flame over the whole turndown range of operation. The burn-back burner was tested in this manner but it proved difficult to supply sufficient air to extinguish the flame. The proven region of stable flame, when the total aeration was at least stoichiometric, is shown as a function of primary aeration and throat loading in Figure 15. The range of gasifier product gas, primary air, and secondary air velocities over which the flame has been observed to be stable are presented in Table 9, and further details are given in Appendix B.

The combustion diagram for the burn-back burner, based on batch test runs 11 to 14, is shown in Figure 16. The experimental flue gas analyses for CO_2, CO, and O_2 are superimposed on the theoretical curves calculated from the combustion model presented in Appendix B. The very good correlation of actual flue gas analyses and the predicted ones confirms that complete combustion of gasifier gas occurs with the burn-back burner.

Future Design -

A possible full scale version of a burn-back burner which incorporates the experience gained from the above batch tests is presented in Figure 17. It will be noted that the moving surfaces are out of contact with gasifier product gas and that these surfaces are purged with air to minimise coking. It will not be necessary for a complete seal off of the gasifier gas duct from the boiler during a burn-back (which would be practically difficult to arrange) since a small air flow into the boiler will not seriously affect the operation.

FLAME STABILITY—PRIMARY AERATION DIAGRAM FOR EXPERIMENTAL BURNER

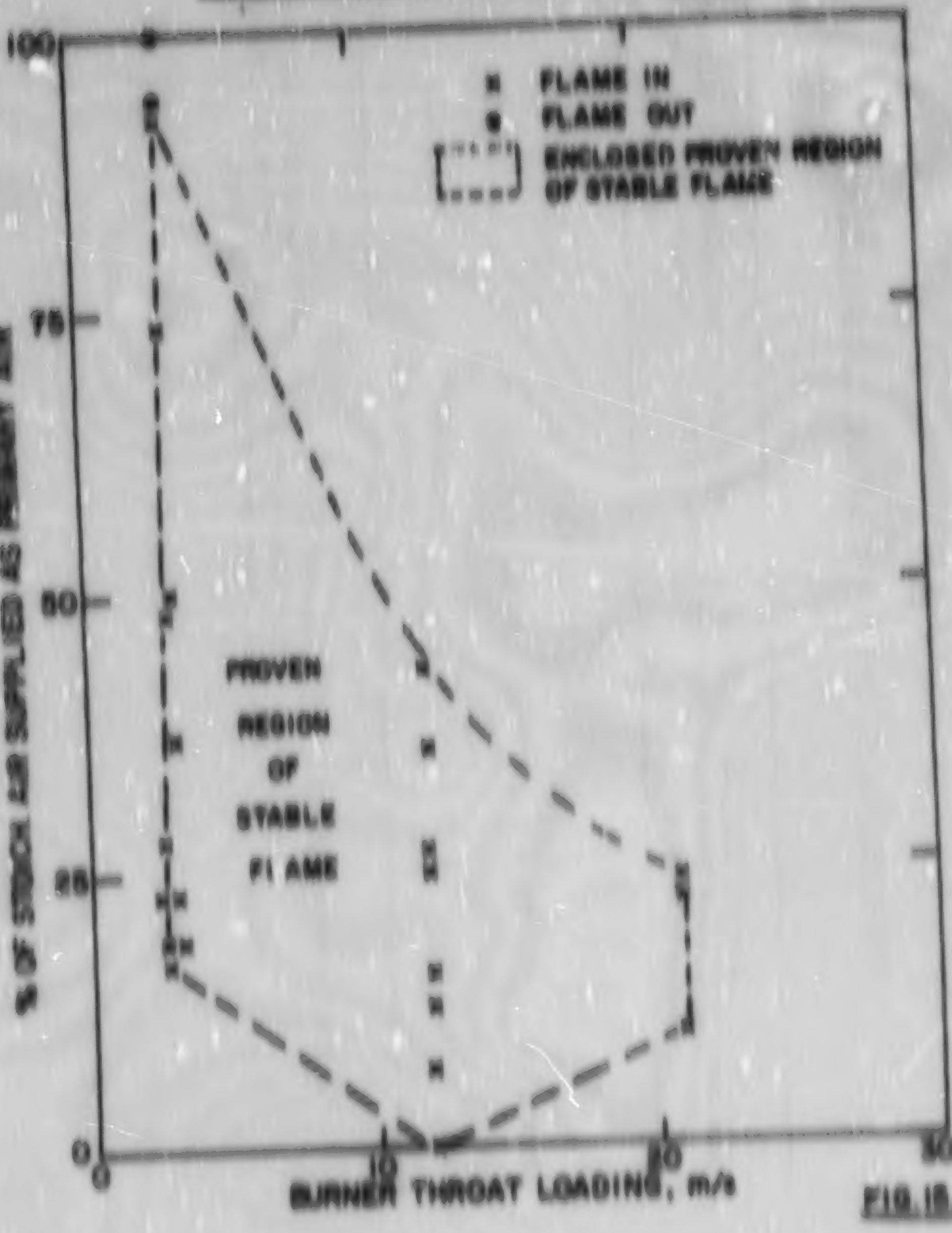


FIG.15.

Table 9

Range of Burner Parameters giving a Stable Flame

Run No.	Burner Throat Loading* m/s	Primary Air Velocity through Input Pipe m/s	Secondary Air Velocity through Shroud Holes m/s/hole
10	21 ± 6	0 to 12.9	10 to 50
12 and 14	12 ± 2	0 to 15.5	0 to 45
11 and 13	3 ± 1	0 to 14.0	0 to 45

Burner throat loading = Rate of flow of gasifier product gas per unit area between outer surface of primary air pipe and refractory lining.

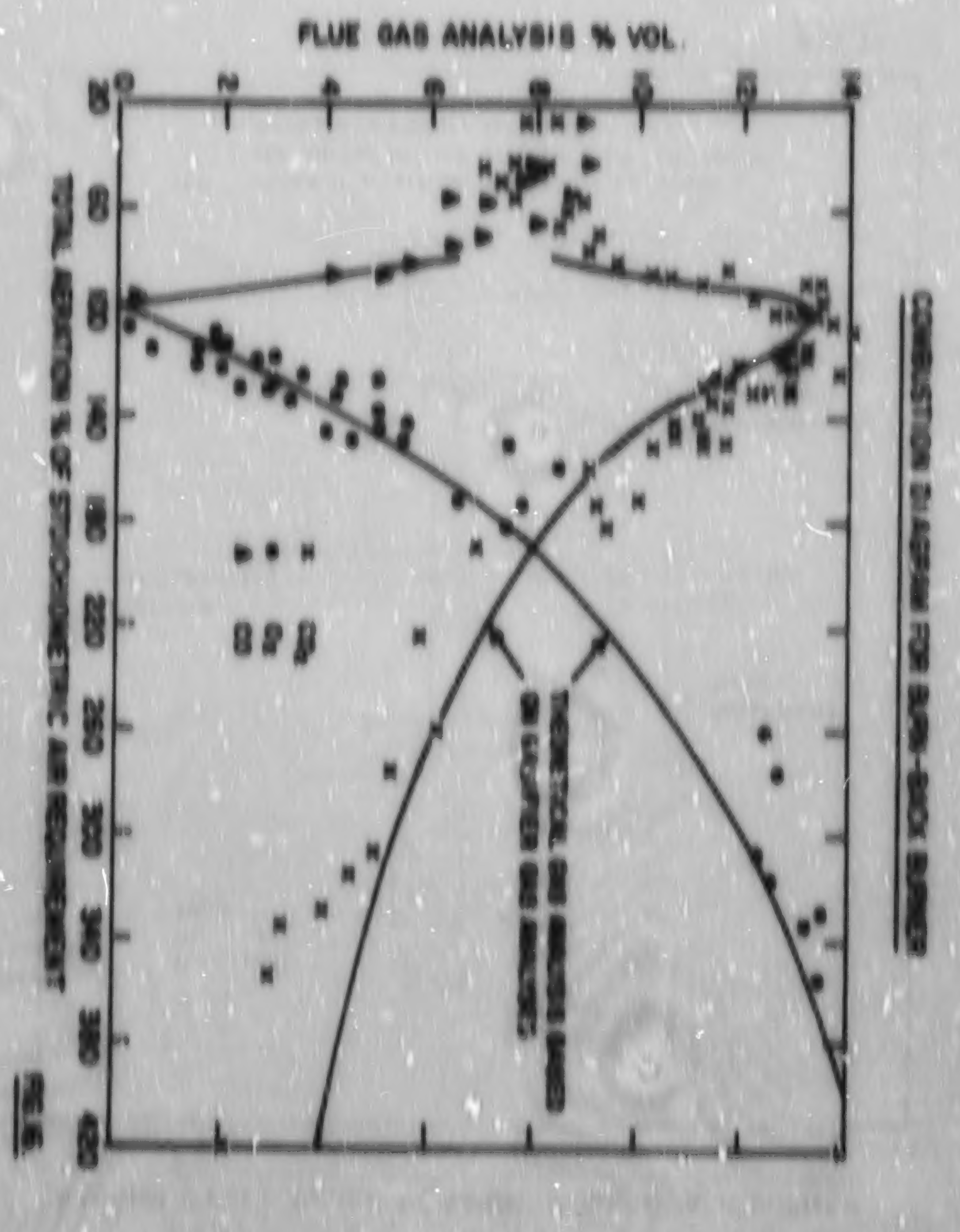
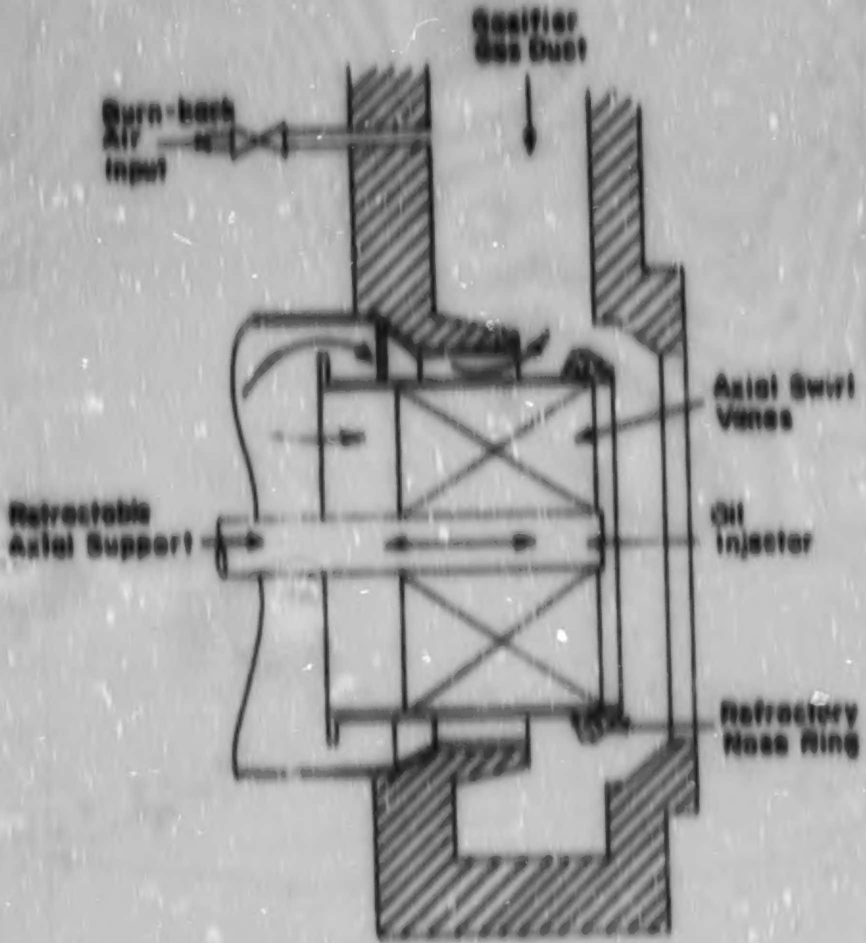

COMBUSTION DIAGRAM FOR SUPA-SACK BURNER
FLUE GAS ANALYSIS % VOL.
0
2
4
6
8
10
12
14
20
60
100
140
180
220
260
300
340
380
420
TOTAL AERATION % OF STOICHIOMETRIC AIR REQUIREMENT
× CO_2
● O_2
▲ CO

FIG. 15

POSSIBLE FULL SCALE VERSION OF BURN-BACK BURNER



N.B. In shut position the nose ring plugs the Burner Orifice with 1/16" – 1/8" clearance between refractory surfaces

FIG. 17

Deadburning and Sulphation of Spent Lime

Introduction -

The deadburning and dry sulphation work described in this report was initiated when the CAFB demonstration plant was based on the choice of Providence, Rhode Island as the plant site, and dry sulphation was the preferred design option for SO_2 and lime disposal. However, the current plan is for Foster Wheeler Energy Corporation to build the demonstration plant in San Benito, Texas using the Foster Wheeler Resox process for SO_2 disposal. In view of this development deadburning became the preferred design option for lime disposal. Consequently the dry sulphation results obtained in this work were not analysed to the fullest extent possible.

Dry Sulphation

Background and Objectives -

In the dry sulphation process spent lime at 800-900°C in the presence of air is used to absorb the SO_2 released from the regenerator. The reactions involved are as follows:

$$CaO + SO_3 \rightarrow CaSO_4 \quad -(1)$$
$$CaO + SO_2 + \tfrac{1}{2}O_2 \rightarrow CaSO_4 \quad -(2)$$

The two by-products are, therefore, treated by a single process to form a single environmentally acceptable material for sale as gypsum or disposal as landfill.

The dry sulphation process has been studied extensively (1 - 10 and 13) and theories for the mechanisms of SO_2 absorption have evolved (10 - 13). There would appear to be two ways in which the sulphation of CaO, reaction (2), can occur. The CaO and SO_2 can react to form $CaSO_3$ which is subsequently oxidised to $CaSO_4$, or else the SO_2 can be oxidised to SO_3 which subsequently reacts to form $CaSO_4$ directly. Evidence has been presented to support the predominance of the latter route at temperatures above 850°C (11).

An optimum sulphation temperature in the region of 870°C has been identified (Figure 16). It is interesting to consider why the optimum temperature is so far below 1100°C, the temperature at which the thermodynamic data would allow a SO_2 absorption efficiency of about 90%.

Three factors may be expected to limit the reaction rate between particulate solids and a gas over a range of temperatures. These are the rate of the chemical reaction itself, the rate of diffusion of the gaseous reagents through the surface film and the rate at which the gaseous reagents diffuse through the reacted solids. The observed rate is never higher than that resulting from any of the individual steps acting alone, because of the series relationship between these resistances to reaction. As can be seen in Figure 19, the chemical reaction rate is highly temperature dependent and soon ceases to be a controlling factor as the temperature rises. Film resistance tends to diminish less rapidly as temperature rises and soon takes over from chemical reactivity as the controlling factor. Reacted solids diffusion resistance tends to rise with increasing temperature. The combined effect of these three influences is therefore to produce an optimum temperature for reaction; but, since the thickness of the reacted solids layer will increase as the reaction proceeds, it follows that the optimum temperature should fall as the solid reagent is utilised. The argument suggests that the optimum temperature for the absorption of the gaseous reagent can be lower than that suggested by thermodynamic considerations.

Prior to the work discussed below there appears to have been no sulphation test runs on a semi-pilot plant scale using a fluidised bed of spent lime discarded from a continuous CAFB unit. The objective of the present work was to determine the practical feasibility under various operating modes on a semi-pilot plant scale of sulphating spent lime withdrawn from the CAFB continuous unit. The target performance factors were:

i) 90% absorption of SO_2 from regenerator off-gas
ii) 90 mole% sulphation of spent lime
iii) 100% oxidation of residual CaS on spent lime.

OPTIMUM TEMPERATURE FOR SULPHUR OXIDE ABSORPTION BY LIME (31% OF BED REACTED)

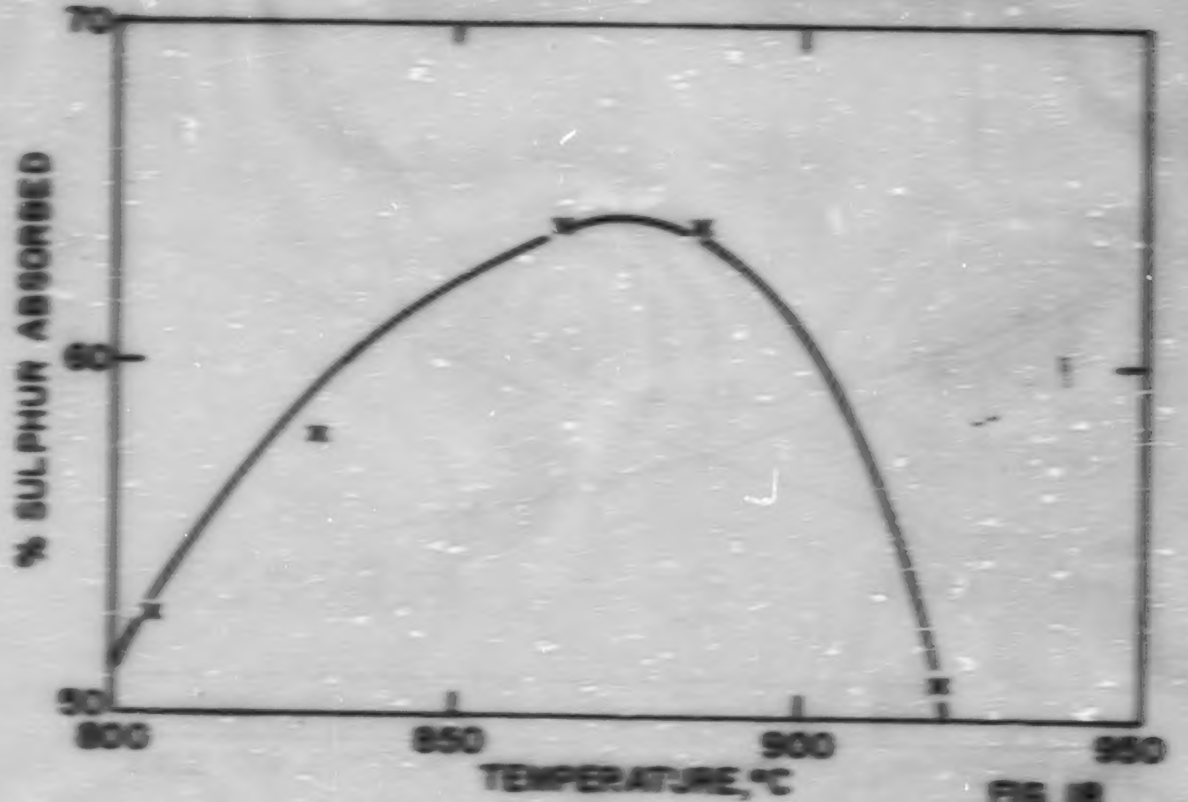


FIG. 18.

RATE CONTROLLING FACTORS FOR GAS-SOLIDS REACTIONS

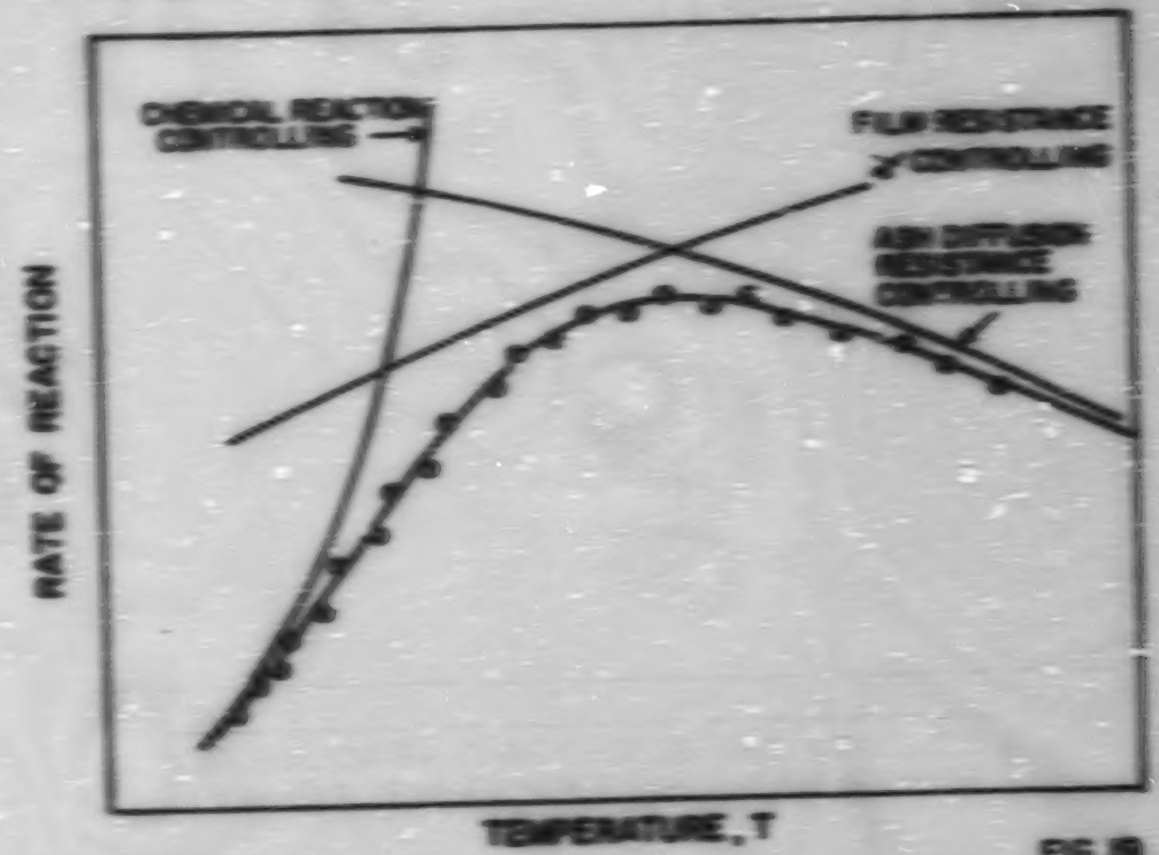


FIG.19.

Fluidised Bed Batch Tests -

The fluidised bed batch sulphation of spent lime tests are summarised in Table 10.

Purely practical considerations limit the range of choice available so far as particle size is concerned. Thus bed particles must be small enough to be fluidised at the superficial gas velocity chosen for normal operation, but large enough to be retained by the cyclones of the reactor. The size distribution about the mean will depend upon the method used to prepare the stone, but sieving must be minimised since it is desirable to discard as little stone as possible. Very fine lime, of less than 100 microns mean particle size is in any case difficult to fluidise and tends to rat-hole.

The fluidisation behaviour in a one inch diameter unit of fine particles of CAFB regenerator material was not satisfactory and the bed agglomerated (9). Consequently the tests were carried out in fixed beds. More recent larger scale batch tests (14) illustrate the difficulty experienced in attempting to maintain bed fluidisation and in achieving 60% sulphation.

It would appear to be sensible to take advantage of the higher specific surface of finer material. Borgwardt (8) has demonstrated that calcium utilisation in sulphation increases markedly as particle size decreases, plugging of the gas-transport pores in the solid becoming less of a barrier to reaction as the diffusion thickness of the product decreases. Thus, following the successful cold fluidisation of 75 microns spent lime, an attempt was made to operate the CAFB batch reactor at the sulphation temperature of 850°C. The fine lime particles became loosely bonded into cakes very shortly after they were fed into the vessel, as expected.

A bed of elutriator coarse spent lime material was fluidised by an SO_2 containing gas. The results were rather disappointing since only 66% of the SO_2 was absorbed under the test conditions when the stone was 17 mole % sulphated. A sample of the bed material was subsequently sieved into closely size fractions which were then analysed for sulphur. The results which were obtained are shown in Table 11.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	[illegible]	[illegible]	-	-	-
[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]
[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	22.5	[illegible]

Table 11 : Sulphur in Stone Fractions

SIZE INTERVAL microns	SULPHUR CONTENT wt. %
2800 - 1400	6.32
1400 - 1180	6.58
1180 - 850	6.73
850 - 600	7.43
600 - 250	8.13
250 - 150	12.74
150 - 106	17.34
< 106	7.96

The sulphur contents of the two finest fractions are of particular interest. A large proportion of the material in these fractions was too fine to have been retained by the bed during fluidisation and was probably produced during the subsequent sieving operation. This being so, it is reasonable to infer from these results that the dust produced from the surfaces of the larger sulphated particles is not pure sulphate but contains a large proportion of lime. The implication here is that the depth of penetration of the particles by SO_2 is very restricted and that sulphation proceeds in the main via the internal surfaces of pores and fissures. This is supported by the way in which sulphur content varies with particle size in Table 11. The 3000 micron stone is about 12.6% reacted and according to the shell model the 700 micron stone should therefore have been about 35% reacted whereas in actual fact it was reacted to the extent of 15.4%. In a paper by Hartmann and Coughlin (10) it is shown that sulphation proceeds via pores having diameters exceeding 4000 Å. It is pointed out by these authors that the molar volume of $CaCO_3$ is 36.9 cm^3/mole whilst that of $CaSO_4$ is 52.2 cm^3/mole. It follows that the pores will close up as the sulphation proceeds. This point is very clearly illustrated with the data plotted in Figure 20, which shows the pore size distribution of a sample of limestone both after calcining and after its subsequent sulphation.

The possible explanation can be found using the concept of "grain theory" introduced by Szekely and Evans (12) and developed by Pigford and Sliger (13). The theory assumes that the porous particles are composed of grains separated by pores through which the reacting gases diffuse.

PORE-SIZE DISTRIBUTION OF THE CALCINED(1) AND SULFATED(2) STONE

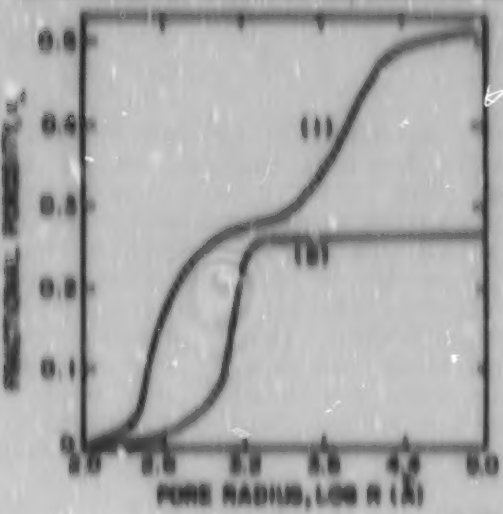


FIG. 20.

The reaction starts on the fresh surface of the subparticles at high rate. The $CaSO_4$ accumulates on the surface of the grains and the diffusional resistance increases rapidly as the reaction proceeds. The volume of each subparticle grows and the porosity of the particle decreases as described in Figure 20. After some elapsed time the resistance of the $CaSO_4$ film is so large that SO_2 can no longer reach the active CaO in the grain. Although the particle can still show some porosity at this stage and SO_2 can slowly penetrate its interior, the reaction effectively ceases for practical purposes. Following this line of argument it is concluded (10) that it is difficult to sulphate lime in a dry process to a greater extent than 60% reacted without in some way modifying the particle structure during the reaction.

Two approaches to this problem were explored in the batch and continuous studies:

1. The injection of fine spent lime particles into a fluidised bed of coarser particles of spent lime or an inert material which was used to hinder the entrainment of the fines. This procedure enabled advantage to be taken of the large surface area of the fine lime whilst ensuring that the quality of fluidisation was maintained and the mean residence time of the fine particles was increased.

2. The injection of coarse spent lime particles into a fluidised bed of particles of an inert abrasive material, such as silicon carbide, which is used to try to grind the injected lime. The fracture of the polycrystalline spent lime would produce fresh CaO surfaces and allow rapid sulphation to be maintained giving high CaO conversion.

In batch run 3 spent lime (10% of total bed weight) of 356 microns mean particle diameter was added to a fluidised bed of silicon carbide of mean particle diameter 470 micron (Table 10). Kerosine was added to the bed to maintain the temperature; this together with the carbon of thestone resulted in about 10% vol. of CO_2 in the exit gas. The sulphation profile for the run is shown in Figure 21. The fine bed material was 50 mole % sulphated after about 2 hours reaction. The cyclone material was sulphated to the same extent as bed material of the same size range. The corresponding SO_2 absorption was about 24%. The maximum calcium oxide to sulphate conversion of fine bed material of 58 mole % in this batch run is the highest yet achieved in a fluidised bed on a relatively large scale. A reaction time of

SULPHATION PROFILE FOR RUN NO.3.

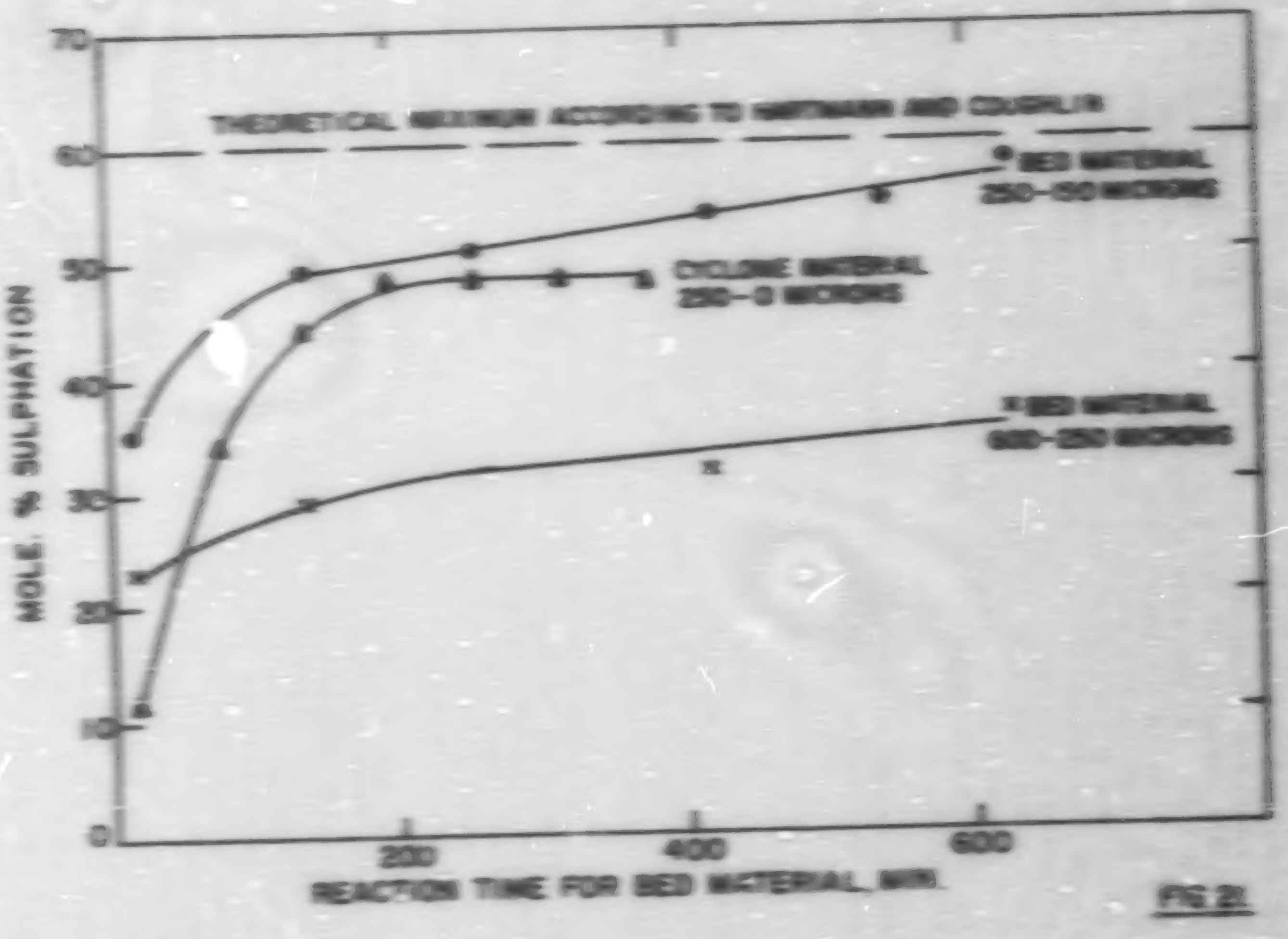


FIG.21.

about 10 hours was required to compensate for the considerable drop off in reaction rate with increased sulphation. It took a further 8 hours after 50 mole % sulphation to sulphate the spent lime a further 8 mole %. It was not possible to sulphate the spent lime beyond the maximum of 60 mole % predicted by Hartmann and Coughlin (10). There was no evidence for the occurrence of bed grinding from the observed bed and cyclone sieve analyses. The overall spent lime and sulphur recovery was about 90%.

Fluidized Bed Continuous Feed Sulphation Tests - It is not sufficient merely to demonstrate high levels of sulphation by means which would not be practical on a commercial basis. The operation of a large scale batch sulphator with reaction times of the order of 10 hours or more was considered to be not commercially viable.

Two possible continuous feed sulphator designs were tested out in Runs 4 to 10. One of these designs is illustrated in Figure 22; operation on this continuous feed basis has a number of advantages over batch-working:

1) less storage of discarded CAFB material is required.
2) consequent reduction in fuel costs otherwise required to reheat the material to the optimum operating temperature.
3) sulphated product is automatically elutriated into the cyclones.
4) coarse inert material, if any, in the bed is separated from the product rather than requiring sieving off at the end of the batch run and subsequent reheating.
5) elutriation of the product allows the maintenance of a constant bed depth.

Six continuous sulphation runs covering a wide range in operating conditions (Table 12) were carried out. Both spent lime and silicon carbide initial beds were tested. The detailed operating conditions are given in Tables D.3 to D.11 in Appendix D.

An alternative continuous operation was tested. Sulphated lime was withdrawn directly from the fluidized bed rather than from the cyclone. This method has the advantage that lower superficial gas velocities may be used. The detailed operating conditions are given in Tables 12, D.9, and D.11.

All of the runs demonstrate that continuous-feed dry sulphation is unlikely to be commercially or technically feasible. The maximum calcium oxide to sulphate conversion achieved was of the order of 40 mole %.

POTENTIAL CONTINUOUS FEED SULPHATOR

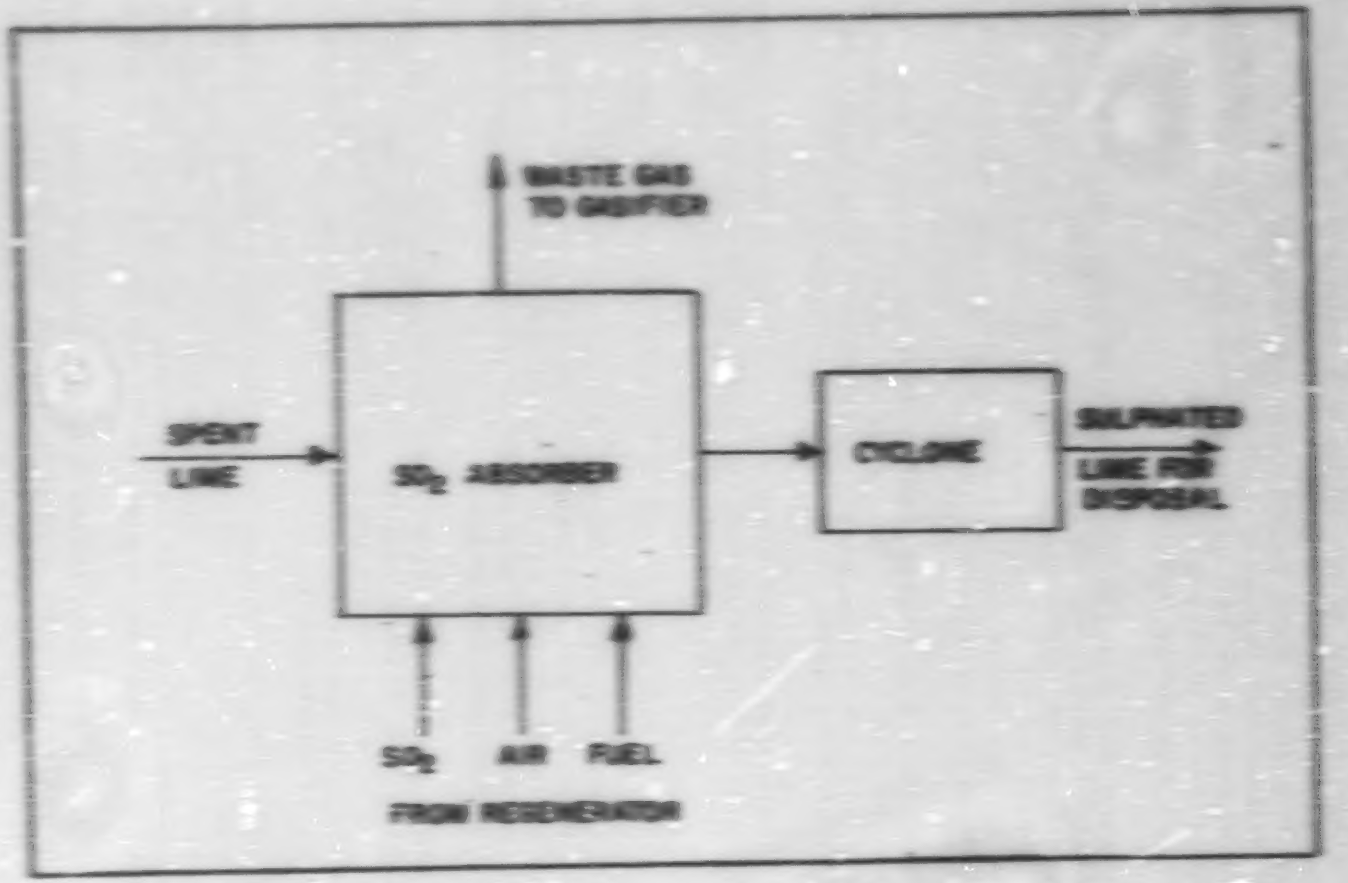


FIG.22.

[illegible]

[illegible]	[illegible]	[illegible]		[illegible]	[illegible]					[illegible]
		[illegible]	[illegible]	°C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
					[illegible]					
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	–	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	–	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	–	–	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	–	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	–	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	–	[illegible]

Deadburning of Spent Lime

Background and Objectives -

It was considered that the spent lime could be rendered inert, and therefore suitable for disposal, by sintering at high temperature. This process would be used in conjunction with a process for reducing SO_2 to elemental sulphur. Although two processes and two products are involved in this route one of the products, sulphur, is marketable and the other, sintered lime, could be produced in relatively small amounts by minimising the gasifier bed replacement rate. Gasifier bed stone replacement could be reduced to the minimum necessary to maintain satisfactory sulphur removal efficiency as it would be independent of the regenerator SO_2 output.

Deadburning of the lime in the temperature range 1500 to 1700°C has been reported (16) to virtually eliminate its chemical activity. The material produced is practically as inert and stable as its limestone antecedent. Compared with normally calcined lime, it has a much higher specific gravity and greatly reduced porosity. In addition, tests at Westinghouse Research Laboratories have indicated that chemical activity of spent lime from the CAFB process can be virtually eliminated when it is exposed to 1400°C for 1 hour (Table 13).

TABLE 13

Effect of Temperature on Spent Lime Activity

Sintering Temperature, °C	Temperature Rise of Hydration °C
No treatment	77.5
1300	98.5
1400	0.38
1500	0.36
1550	0.34

It was considered that deadburned lime of this nature would age on exposure to the weather to form inert $CaCO_3$ over a prolonged period of time.

The rapid material temperature rise due to the evolution of heat from the "slaking" reaction between finely divided calcium oxide and water to produce water soluble calcium hydroxide was not expected.

The objective of the present work was to examine the feasibility of spent lime sintering as a means of treatment which is environmentally acceptable before disposal as landfill.

The test programme was to produce a range of sintered spent lime samples, varying the sintering temperature and duration. These samples were exposed to weathering over a twelve month period. The temperature changes relative to ambient conditions were monitored and compared with a non-sintered spent lime sample under similar conditions. The chemical compositions of the spent lime and the rain water which had leached through the samples were determined at regular intervals by analysis.

Discussion of Results

Six containers were left outside and rainwater was allowed to leach through the sintered spent lime in the upper vessel and into the lower one, as shown in Figures 23 and 24.

A maximum temperature rise of 5°C above ambient was steadily built up after 20 hours of exposure to weather for the sintered spent lime. This behaviour was in marked contrast to that of non-sintered spent lime which showed a 30°C rise in the first hour of weathering due to the rapid 'slaking' of the calcium oxide by atmospheric water vapour. The temperature profiles of all the sintered spent lime samples were similar and independent of the sintering conditions. The temperature profiles of sintered and non-sintered spent lime are shown in Figure 25.

Within two weeks weathering, all sintered spent lime samples had formed a crust over the upper surface which was most in contact with atmospheric CO_2, water vapour, and rainwater. The material was normally thoroughly mixed every month to ensure that the sample taken was homogeneous. The effect of weathering on the molar % of total calcium for CaO, $Ca(OH)_2$, $CaCO_3$, CaS, and $CaSO_4$ is shown in Figures 26 and 27 based on the analyses and chemical compositions given in Appendix C.

Fig 23 Weathering of Sintered Spent Lime

Fig 24 Weathered Sintered Spent Lime after 12 Months

EFFECT OF WEATHERING ON SAMPLE TEMPERATURE FOR SINTERED AND NON-SINTERED SPENT LIME

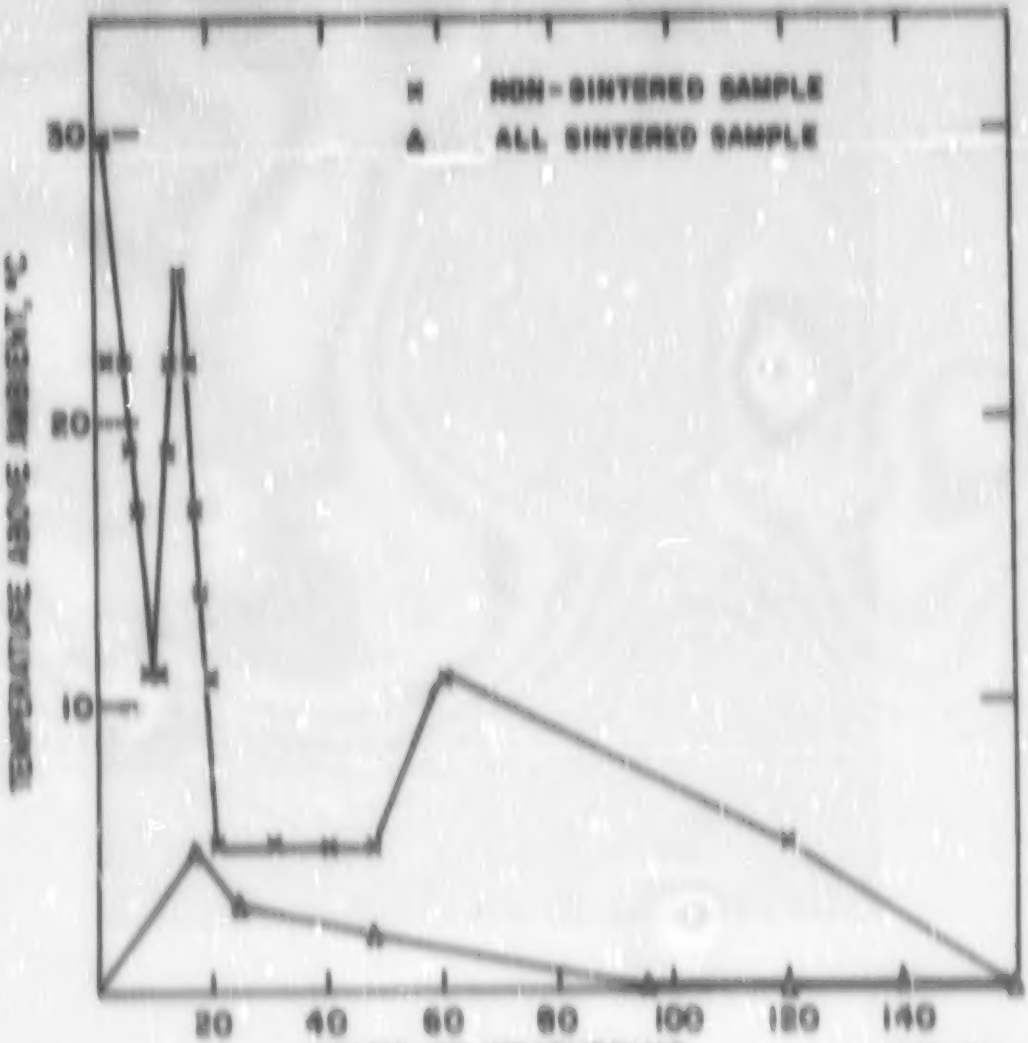


FIG. 25.

EFFECT OF WEATHERING ON MOLAR % OF TOTAL CALCIUM FOR CaO AND $Ca(OH)_2$

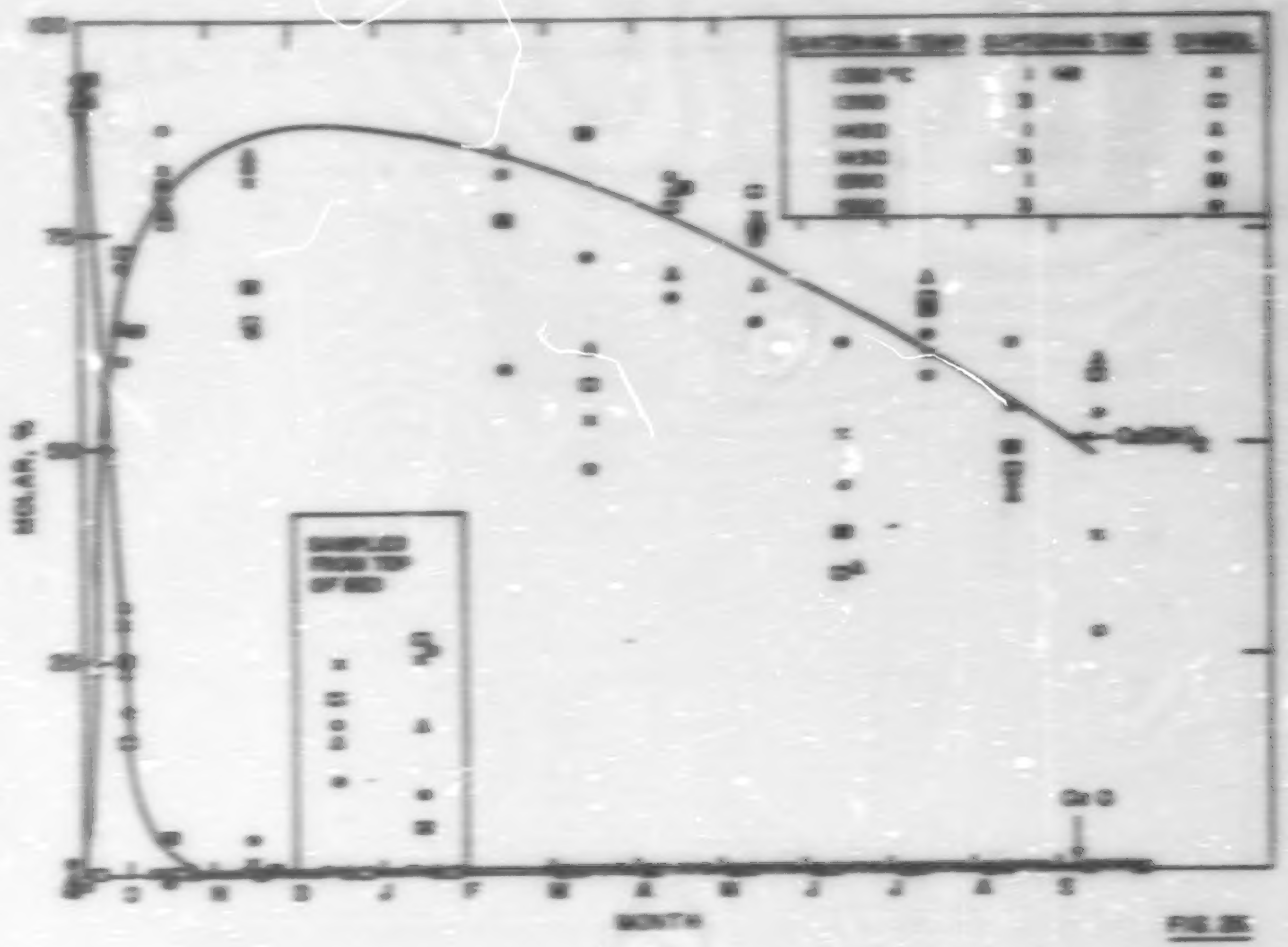


FIG. 25

EFFECT OF WEATHERING ON MOLAR % TOTAL CALCIUM FOR $CaCO_3$, CaS, AND $CaSO_4$

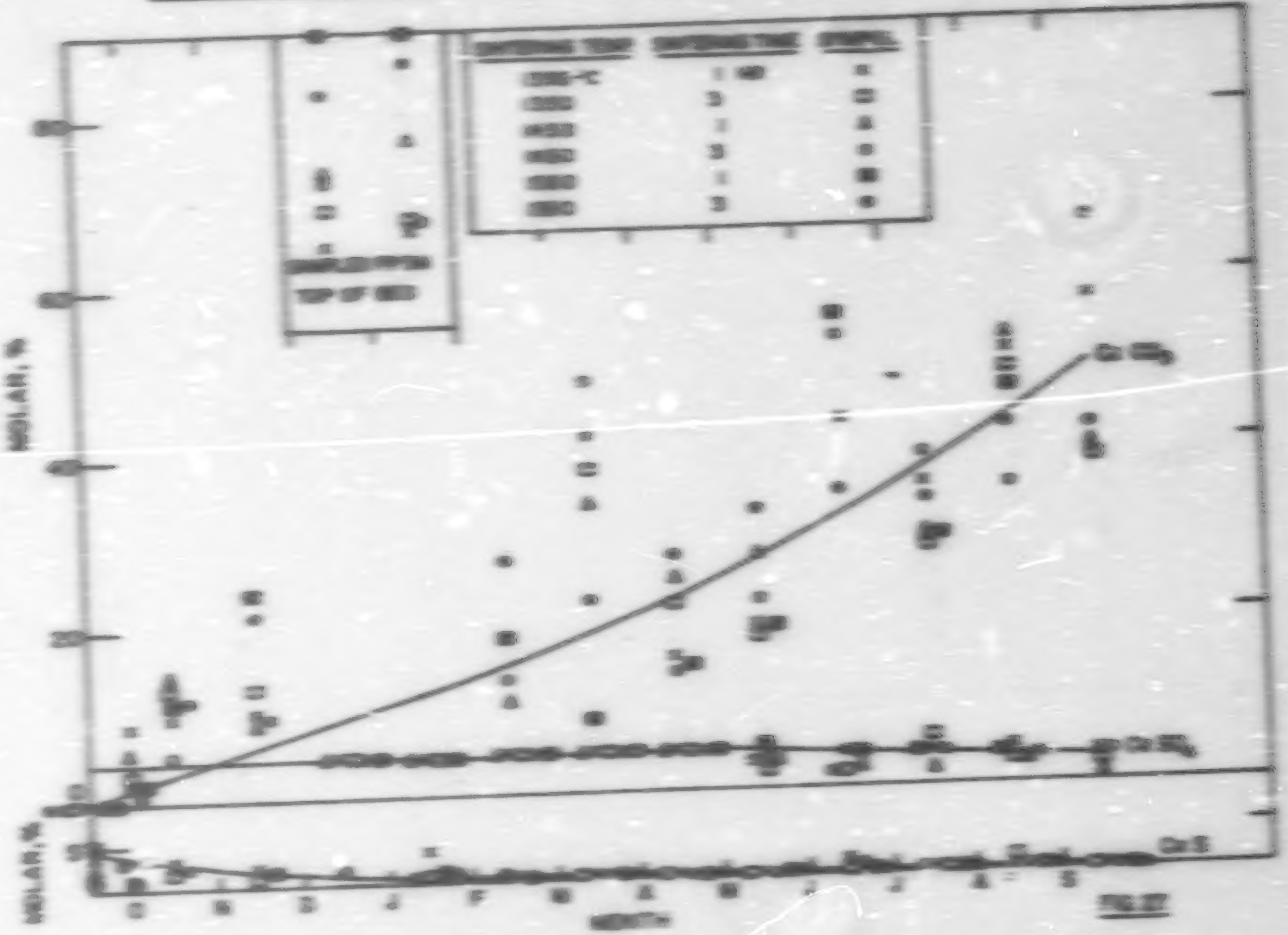


FIG. 27

The following conclusions may be drawn from Figures 26 and 27.

- Variation of the sintering conditions within the range 1 hr. at 1350°C to 3 hr. at 1550°C had no effect on the chemical changes which occurred on weathering.
- The chemical changes occurred steadily during weathering and were not dependent on the monthly rainfall.
- All CaO was converted to Ca(OH)$_2$ after 2 months weathering.
- After 12 months weathering the sintered spent lime consists mainly of Ca(OH)$_2$ and CaCO$_3$ in 1:1 molar ratios. The CaCO$_3$ was formed from the Ca(OH)$_2$.
- Weathering occurred faster in the top layer crust of the sintered lime. For December and January the samples were taken from this crust.
- The experimental scatter of the data is a measure of the effectiveness of the monthly mixing operation.

The weathering rate was greater under the test conditions than would occur naturally with landfill since the test material was regularly mixed. This repeated exposure of fresh reactive material would not occur during landfill operations.

The analyses of the sintered spent lime leachates are given in Appendix C. The evaporation losses from the leachates in the lower containers were analogous to those of a stagnant pond. The maximum concentrations of various metals are compared with World Health Organisation Standards for Potable Water in Table 14.

Table 14 : Leachate Analyses

METAL	Ca	Mg	Si	Fe	Al	Na	V
CONCENTRATION MAX., ppm	1800	3.1	13	0.2	<1	182	14
MONTH	June	June	Nov.	April	All	Oct.	Oct.
SINTERING TEMP. °C	1450	1350	1350	ALL		1350	1550
TIME, hr.	3	1	1	SAMPLES		1	1
W.H.O. STANDARD FOR POTABLE WATER, mg/l.	75	50	-	0.3	-	-	-

The following conclusions may be drawn from the above Table 14:

- Variation of the sintering conditions within the range 1 hr. at 1350°C to 3 hr. at 1550°C had no effect on the leachate meatl concentrations.
- The leachate metal concentrations were not dependent markedly on the rainfall or the duration of the weathering period.
- The maximum calcium leaching loss was 0.4% of the total calcium present initially.

CONTINUOUS PILOT PLANT STUDIES

Analysis of Continuous Runs 8 and 9

Outline of Method of Analysis -

A previous report in this series (2) describes how the data from Continuous Runs 6 and 7 were analysed. Essentially the hourly readings were grouped into ten hourly sets of data in which conditions were sufficiently constant to allow meaningful average values to be derived. A major drawback in such an approach is that not all the data can be used. Gross effects were identified by plotting % sulphur removal efficiency (% S.R.E.) against individual independent variables such as bed depth or bed sulphur concentration. This approach is excellent if the experimental design is such that only one significant variable is altered at any given time. Unfortunately this is not always possible and the effect of one variable can often be obscured by variations of another.

The method of analysis used for Runs 8 and 9 differed from that adopted for previous runs in that the hourly readings were treated separately. Stepwise multiple regression analysis was used to identify the contribution of significant process variables and empirical equations were developed to predict the % S.R.E. for each separate hour of the runs. The underlying objective in this approach was to use all the data generated throughout the runs or at least to justify any that needed to be discarded.

Initially, Runs 8 and 9 were treated separately and regression equations were developed to explain each set of data. The two runs were then looked at as a whole to try to synthesise the two sets of observations to give one common picture or at least to identify why they should differ.

A useful tool in developing the regression equations and identifying significant variables was the graph plotting computer programme written to generate the run graphs shown in Appendices F and G. Each time a regression equation was developed the residual error between the hourly predicted values of % S.R.E. and the experimental values were plotted as a function of time throughout the run. Thus it was possible to zero in on large differences between the predicted and actual values of % S.R.E. and with the aid of the run log-book identify the factors responsible.

The approach outlined above can only be successful if the time lag between a change in process conditions and a system response in terms of % S.R.E. is comparatively short, ie, a matter of minutes rather than hours. Thus the apparent success of this approach indicates short line-out times for the process.

Further details of the method of analysis including prorammes and data editing are to be found in Appendix B of this report.

Summary of Process Data for Runs 8 and 9 -

A useful aspect of regression analysis is that it provides summary statistics which help to give an insight into what happened during the two runs. Table 15 lists the mean values for the % S.R.E. together with several key process variables. Also listed is the standard deviation of each of the variables which is a measure of how that variable was changed throughout a run. Obviously an important variable which significantly affects the process can be overlooked if it is kept constant throughout the run. In assessing the effect of a variable on the % S.R.E. it is important to know:-

(1) Over what range the variable was changed.
(2) What proportion of the time the variable was significantly different from the mean value.

The standard deviation gives a measure of both these aspects. Two thirds of the hourly data lie within one standard deviation of the mean value whereas 95% of the data lies within two standard deviations of the mean value.

% Sulphur Removal Efficiency - Table 15 shows that the overall performance in terms of % S.R.E. for both Runs 8 and 9 was similar. The mean value for the % S.R.E. of Run 9 was only slightly better than Run 8. Comparison of the standard deviation of this variable shows that there was less variation about the mean value in Run 9 compared with Run 8. This is an important observation and will be returned to later in the discussion.

Bed Depth - One of the objectives of Run 9 was to explore deeper beds than previously and this is reflected in a larger mean bed depth of Run 9 compared with Run 8. A larger standard deviation indicates that this variable was also changed more widely in Run 9 than in Run 8.

TABLE 15

Summary Statistics for Runs 6 and 9

	Run 6		Run 9	
Variable	Mean Value	Standard Deviation	Mean Value	Standard Deviation
% Sulphur Removal Efficiency	77.1	10.8	79.1	6.8
Bed Depth (cm)	91.0	11.8	105.1	14.0
Bed Temperature(°C)	891	15.3	921	24.5
Air/Fuel Ratio	23.9	1.9	20.9	3.4
Cyclone Drain Temperature(°C)	365	109	356	134
Added Water(m^3/hr)	16.6	13.1	4.75	8.6
% Bed Fines(600-250μ)	16.4	3.7	18.4	5.9
Bed Carbon (wt%)	0.3	0.5	0.24	0.5
Bed Sulphur (wt%)	5.2	1.8	4.5	1.1
Bed Velocity(m/sec)	1.62	0.17	1.70	0.25
Ca/S Mole Ratio	1.56	0.7	1.23	0.9

Bed Temperature and Air Fuel Ratio - On average Run 9 operated at higher bed temperatures compared with Run 8 and we can see this was largely achieved by operating at a higher air/fuel ratio. Comparison of the standard deviations of both these variables indicates Run 9 again operated over a wider range.

Cyclone Drain Temperature - This variable was used as a measure of the amount of fines circulating from the gasifier bed to the cyclones. In practice, the average of the two cyclone drain temperatures was used to represent this variable. One might expect it to be related to the bed depth and indeed inspection of the correlation matrices presented in Tables H-I and H-II in Appendix H shows that particularly for Run 8 a strong correlation exists. After the completion of Run 8 but before Run 9, modification of the gasifier unit to expand the free board space above the bed was carried out. The intention was to reduce the amount of fines circulation and indeed the higher cyclone drain temperature for a lower bed depth in Run 8 compared with Run 9 reflects this design modification.

Added Water - Table 15 shows that the amount of water added to the gasifier during Run 8 was almost four times that during Run 9. To a large extent this was fortuitous. During Run 8 a consignment of fuel oil with an unexpectedly high level of water contamination was delivered to the bulk storage tanks. This resulted in periods of operation during Run 8 when an emulsion of fuel oil and water containing at times up to 27% water was added to the gasifier. Another major source of water was that introduced during flue gas recycle. The flue gas is passed through a water scrubber system before it is introduced into the gasifier and consequently is saturated with water vapour. A third source of water was steam injection into the plenum air which was carried out over an approximate eight hour period during Run 8.

Bed Fines - Samples of the bed material were taken periodically throughout each of the runs and subjected to sieve analysis. Only a small proportion of the stone feed below 250μ was retained in the bed and the smallest significant faction was that between 500-250μ. The percentage of the total bed material which lay within the range was used as an indicator of bed fines.

Bed Carbon and Bed Sulphur - Comparison of these two variables indicates that the mean values for both runs are remarkably similar.

Ca/S Mole Feed Rate - On average slightly less feed material was used in Run 9 compared with Run 8. Again this variable was studied over a wider range in Run 9 than in Run 8.

Bed Velocity - Except for some brief excursions, the bed velocity was kept reasonably constant at about one m/sec. throughout both runs.

An interesting aspect of the summary statistics in Table 15 is that with the exception of added water and to a lesser extent bed sulphur all the other key process variables were changed over a wider range in Run 9 compared with Run 8 and yet in terms of % S.R.E. the reverse is true. This can only be explained if added water (or bed sulphur) has a large effect on % S.R.E. In fact it was evident at the time when high water levels were discovered in the fuel during Run 8 that this variable had a pronounced detrimental effect on performance.

Linear Regression Equations for Run 8 and 9 -

As a result of a detailed analysis of the data (see Appendix H) and evaluation of a large number of variable combinations, six variables were chosen which best represented the results for Runs 8 and 9. The linear regression equations developed around these variables are presented in Table 16. The only variable which needed to be forced into the regression equation was cyclone drain temperature for Run 8 and this was due to the high correlation between this variable and bed depth for that run. More accurate equations were obtained by using the square of the variable 'added water' and hence the regression coefficient listed in Table 16 reports the square of this variable.

Also included in Table 16 is the residual error of each regression equation and the '% explained' by the regression equation. The residual errors for both equations are virtually identical. The % explained is a measure of how much of the variance in the % S.R.E. is predicted by the regression equation. A higher % explained for Run 8 is a direct result of the greater variation of % S.R.E. in Run 8 and not due to a lower residual error.

TABLE 16

Linear Regression Equations to predict % [illegible] for Runs 8 and 9

Variable	Run 8 Regression Coefficient	Run 9 Regression Coefficient
Bed Depth (cm)	0.15	0.17
Bed Temperature (°C)	-0.035	-0.073
Air/fuel Ratio	0.94	0.38
Cyclone Temperature(°C)	0.0065	0.017
*Added water (m^3/hr)	-0.011	-0.011
Ca/S Mole Ratio	1.96	1.18
Constant	71.8	112.3
Residual Error	3.94	4.06
% Explained	66.8	64.5

* square of variable

Comparison of the regression coefficients for the two runs shows some interesting consistencies and anomalies. All the coefficients are directionally the same in both runs although the magnitude of the contribution is different for some of the variables. The coefficients which compare favourably are for bed depth, added water, and to some extent Ca/S mole ratio. Those for bed temperature, air/fuel ratio and cyclone drain temperature are less consistent and this raises the question why this should be. Previously mentioned design changes could account for the different cyclone drain temperature effect but it is difficult to see why this should also affect bed temperature and air/fuel ratio. To further test whether the runs are in fact different, the regression equation for Run 8 was used to predict the mean value for Run 9 and vice versa. Table 17 shows the results of this calculation. A feature of regression analysis is that it arranges the equation constants to predict the mean of the data precisely so that Run 8 equation predicts Run 8 mean precisely and similarly Run 9 equation predicts its mean precisely. However, the Run 8 equation badly overpredicts the performance of Run 9 whereas Run 9 equation under predicts Run 8 performance.

Analysis of Run 8 and 9 Data to determine the Non-Linearity of Regression Variables -

One explanation for the poor predictions of the regression equations shown in Table 17 is that the regression variables are not linear. To test this assumption the following procedure was adopted:-

(1) Assume as a first approximation all the regression variables are linear except one and correct the % S.R.E. experimental values using the linear regression coefficients for deviations away from the mean values of these five variables.

(2) Plot the corrected % S.R.E. values against the remaining variable and to improve the accuracy average the data into boxes, eg, for bed depth average the results between 50-60 cm, 60-70 cm etc.

(3) Repeat for each variable in turn.

(4) To compare on a common basis Runs 8 and 9 the mean of the two population means in Table 15 was used.

An example of the computer programme written to carry out this task is 'DLRESIDA' listed in Appendix H.

TABLE 17

Prediction of Run 8 Data from Run 9 Regression Equation and Vice Versa

Equation Used	Run 8 Mean % Sulphur Removal Efficiency		Run 9 Mean % Sulphur Removal Efficiency	
	Actual	Predicted	Actual	Predicted
Run 8	77.1	77.1	79.1	83.4
Run 9	77.1	74.9	79.1	79.1

Figures 28-33 show the end product of such an analysis for both Runs 8 and 9. The numbers bracketed against the points refer to the number of hourly readings contributing to each data point. Obviously the larger this number the more accurate the data point and the greater the weight that can be attached to its value.

A striking feature of this approach is how consistent the two runs now appear and shows that the inconsistencies in air/fuel ratio and bed temperature were entirely due to the fact that these variables were non linear.

Development of Polynomial Equations for Runs 8 and 9 -

A standard programme "Polynomial-Fit" also available on the Honeywell MK.II Foreground system was used to find a polynomial expression for each of the relationships given in Figures 28-33. This routine programme calculates coefficients and comparative data for fitting polynomials of the following form:-

$$Y = A + Bx + Cx^2 + D^3 + -- Hx^7$$

where the coefficients may or may not be zero.

A valuable feature of this programme is that it allows weighting factors to be applied to the data points and the hourly readings bracketed in Figures 28-33 were used in this way. Table 18 gives the most significant polynomial expressions for each of the six variables and compares the standard error of the polynomial expression with the corresponding linear expression. In the case of bed depth and cyclone temperature the best polynomial is in fact a linear expression. However, for the other four variables a considerable improvement in accuracy can be achieved as might be expected by drawing a curve through the data.

Using the polynomial expression for each variable, the data for Runs 8 and 9 were re-analysed separately to generate the regression constant and the residual error and '% explained' for the new polynomial equation. The relevant information obtained is given in Table 19. A slight improvement in residual error and '% explained' over the linear equation is noted. Comparison of the regression constants shows that Run 8 equation now over-predicts Run 9 by 2.48 whereas Run 9 underpredicts Run 8 by the same amount.

% SRE VERSUS GASIFIER BED DEPTH

(RUNS 8 AND 9)

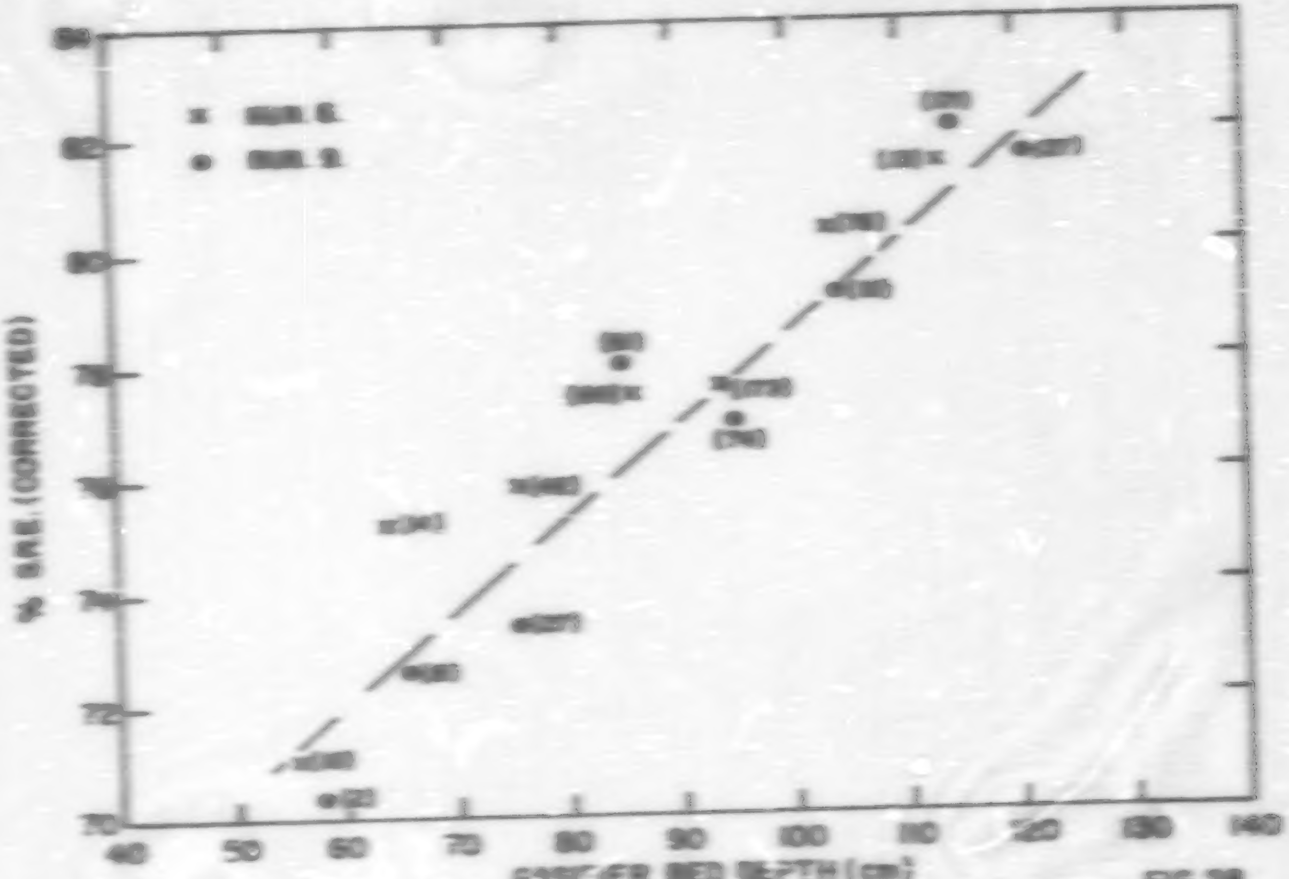


FIG.28.

% SRE VERSUS GASIFIER BED TEMPERATURE

(RUNS 8 AND 9)

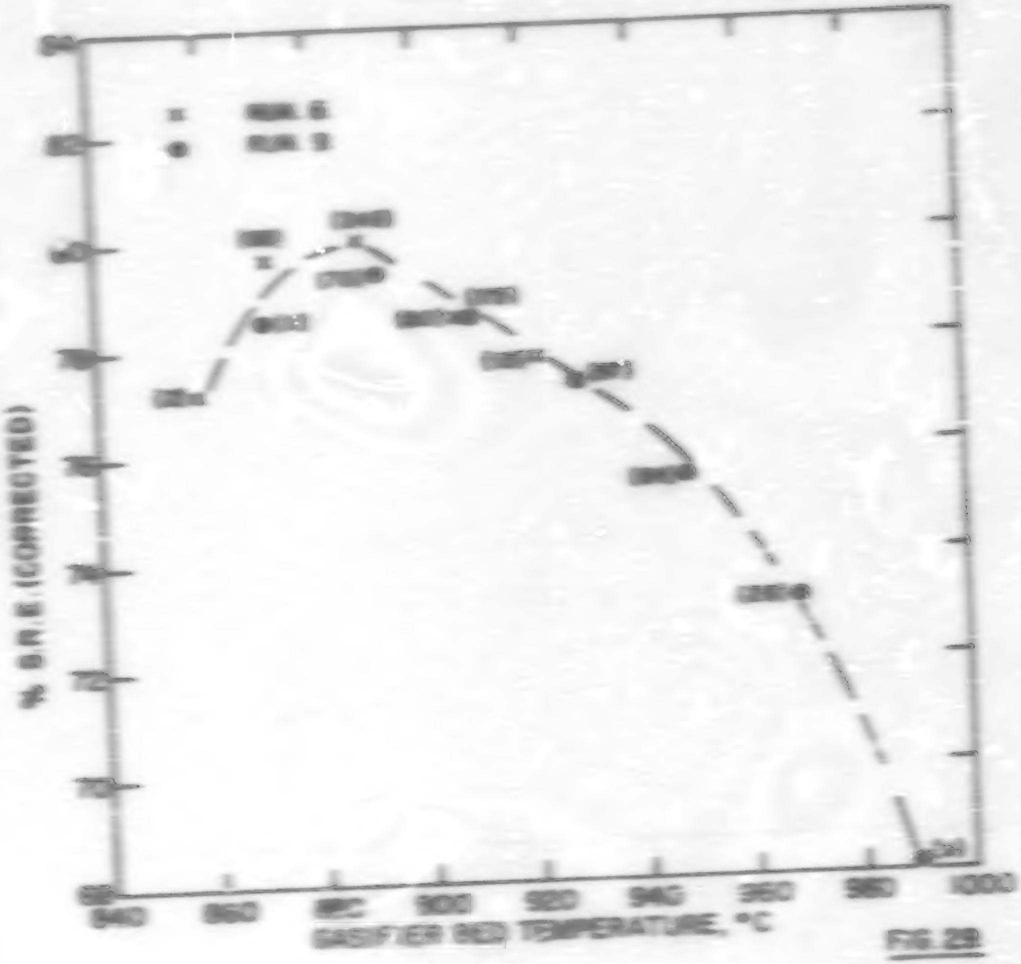


FIG.29

% S.R.E. VERSUS % AIR/FUEL RATIO

(RUNS 8 AND 9)

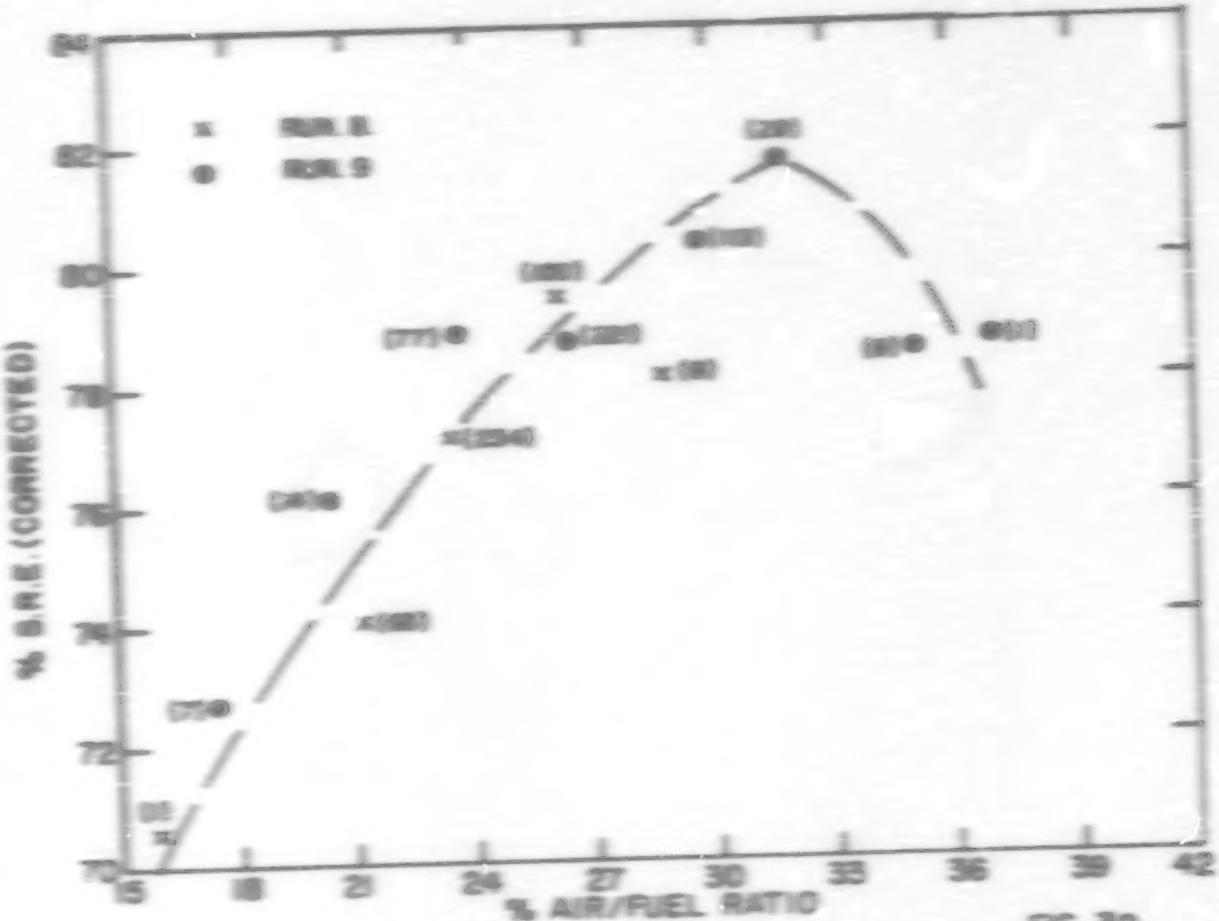


FIG. 30

% SiRE VERSUS CYCLONE TEMPERATURE

(RUNS 8 AND 9)

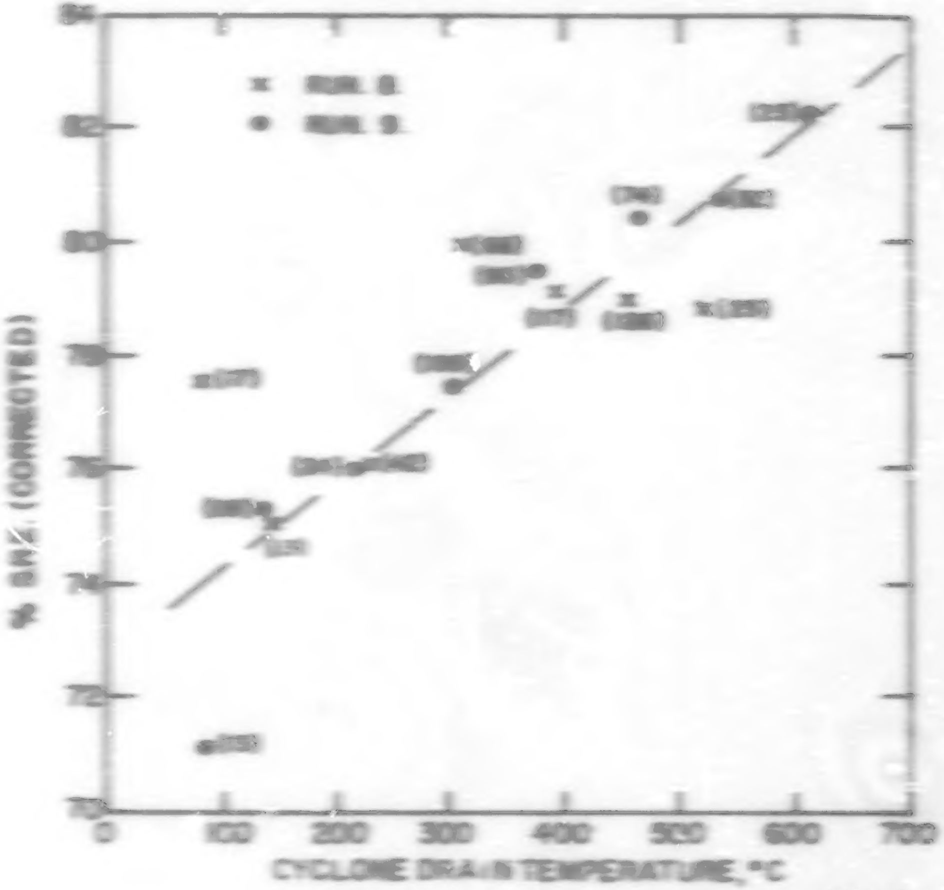


FIG.31.

% S.R.E. VERSUS ADDED WATER

(RUNS 8 AND 9)

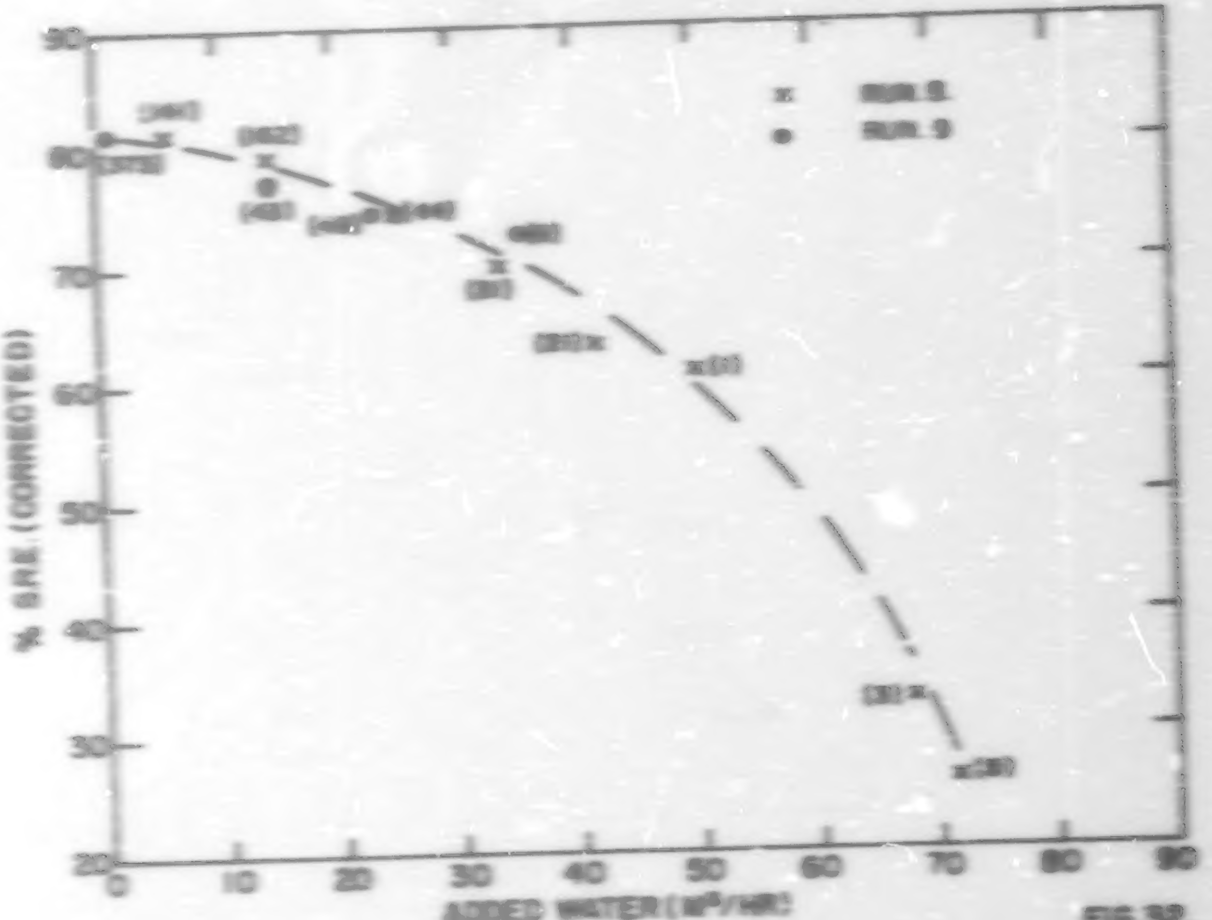


FIG.32.

% S.R.E. VERSUS Ca/S MOLE FEED RATE

(RUNS 8 AND 9)

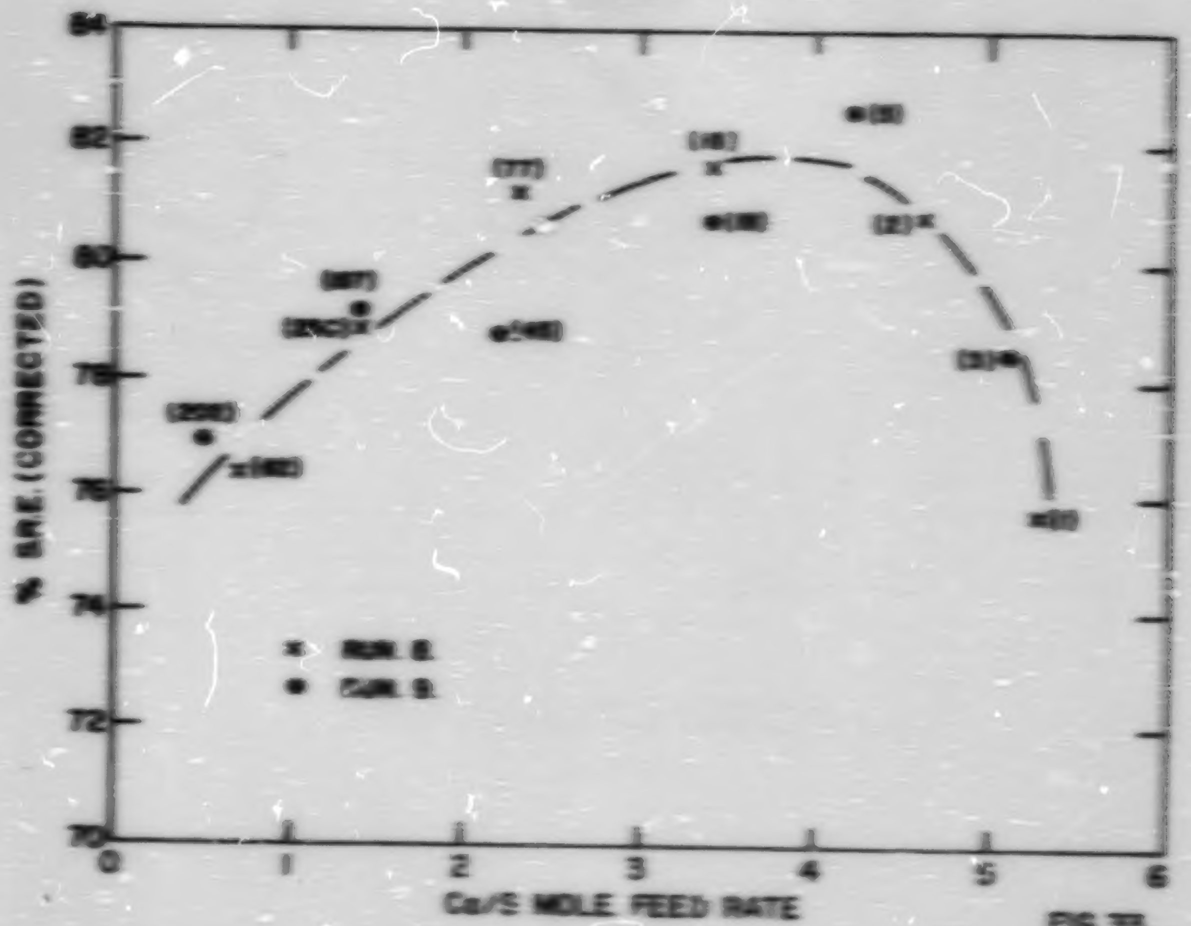


FIG. 33.

TABLE 18

Comparison of Polynomial Regression and Linear Regression for Regression Variables

Variable	Polynomial					Linear	
	Regression Coefficients				Standard Error	Regression Coefficient	Standard Error
	x	x^2	x^3	x^4		x	
Bed Depth (cm)	0.35	-	-	-	1.4	0.26	2.8
Bed Temperature (°C)	1.36	$-7.8x10^{-4}$	-	-	1.0	-0.07	2.3
Air/Fuel Ratio	2.82	$-4.4x10^{-2}$	-	-	1.4	0.5	2.6
Cyclone Temperature (°C)	[illegible]	-	-		1.6	0.053	1.6
Added Water (m^3/hr)	$7.5x10^{-3}$	$-1.8x10^{-2}$	$1.3x10^{-4}$	$-3.2x10^{-6}$	1.9	-0.45	20.2
Ca/S Mole Ratio	2.48	$1.7x10^{-2}$	$-7.9x10^{-2}$	-	1.3	2.5	3.5

TABLE 19

Polynomial Regression Equations to Predict % S.R.E.

Variable	Eq. 8 Regression Coefficients X	X^2	X^3	X^4	Eq. 9 Regression Coefficients
Bed Depth (cm)	0.16	–	–	–	Ditto Eq. 8
Bed Temperature(°C)	1.36	−7.8x10[illegible]	–	–	Ditto Eq. 8
Air/Fuel Ratio	2.82	−4.39x10[illegible]	–	–	Ditto Eq. 8
Cyclone Temperature(°C)	0.0133	–	–	–	Ditto Eq. 8
Added Water (m^3/hr)	7.53x10[illegible]	−1.81x10[illegible]	1.[illegible]x10[illegible]	−1.[illegible]x10[illegible]	Ditto Eq. 8
Ca/S Mole Ratio	2.48	1.76x10[illegible]	−7.82x10[illegible]	–	Ditto Eq. 8
Constant		−575.7			−576.1
Residual Error		3.05			3.02
% Explained		86.9			86.5

In establishing the non-linearity of one regression variable it was necessary as a first approximation to assume linearity of the other five and correct the % S.R.E. values accordingly. Obviously the process can be repeated this time using non-linear corrections for the other five variables. Such an approach would undoubtedly bring the two regression equations further into line but the exercise is costly in time and effort and enters the area of diminishing returns. A simpler approach to produce an overall mathematical equation for Runs 8 and 9 is to take the mean value of both regression constants.

Analysis of Run 8 and 9 Data to Determine Significance of Variables not Included in Regression Equations -

Since the non-linear feature of the variables has been explored, only two factors can now be responsible for the residual errors of the polynomial regression equations ie.

- random experimental error
- signficant variables not included in the regression equation.

Undoubtedly a large proportion of the residual error is in fact random experimental error and this is evident from the the graphs of residual error as a function of time. Nevertheless, it is instructive to analyse additional variables to see whether their incorporation in the regression equation would contribute to the accuracy of the prediction and hence reduce the residual error.

Four variables, bed sulphur, bed sulphate, bed fines and bed carbon were analysed in this way and the results are presented in Figures 34-37. Again the results were averaged in boxes and the bracketed numbers refer to the number of contributing hourly readings.

% Bed Fines (600-250μ) - Analyses of the residual error from the polynomial equations for Run 8 and 9 with respect to bed fines (600-250μ) is presented in Figure 34. Over the range 10%-30% no systematic trend is evident which implies that this variable does not influence the % S.R.E. over the range studied.

% S.R.E. (RESIDUAL ERROR) VERSUS % BED FINES (600–250μ)

(RUNS 8 AND 9)

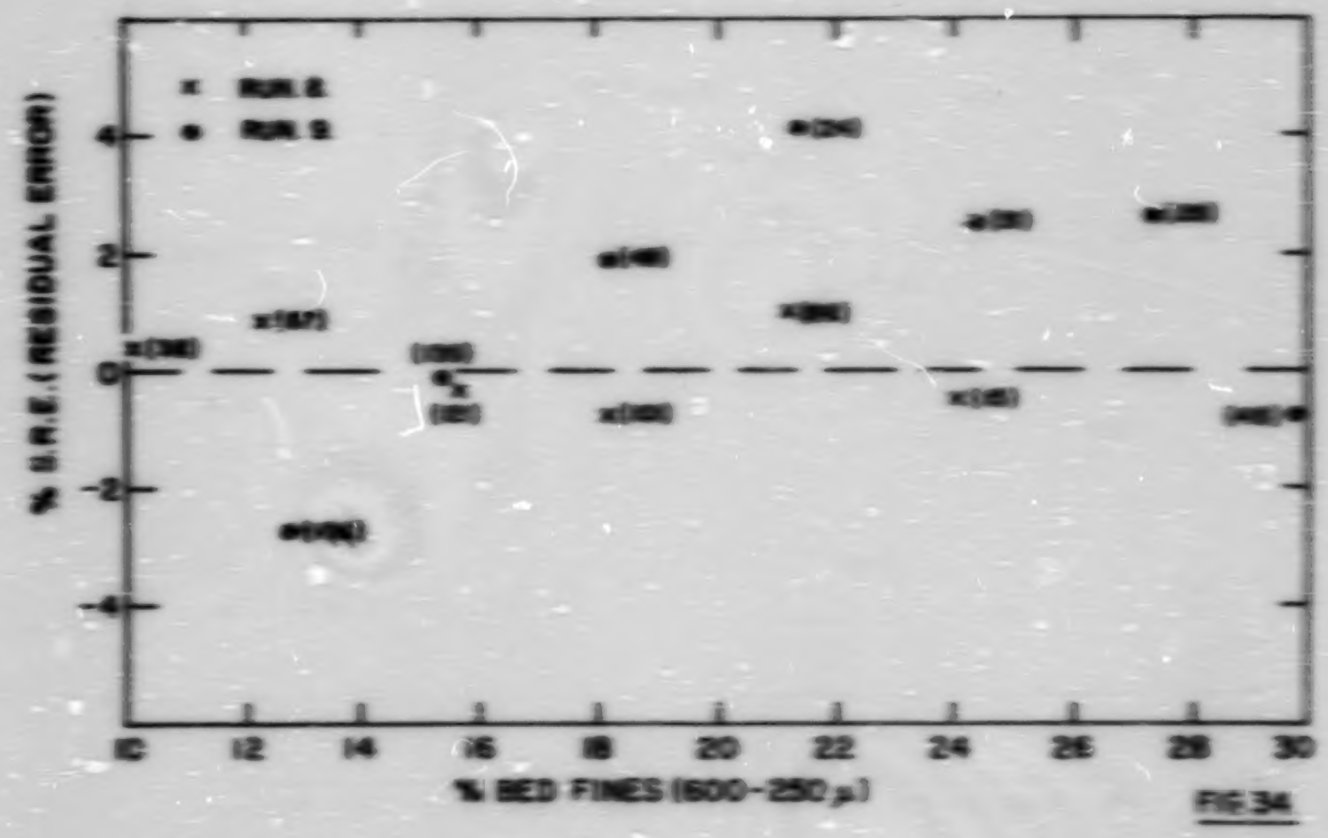


FIG.34

% SRE (RESIDUAL ERROR) VERSUS BED SULPHUR (WT.%)

(RUNS 8 AND 9)

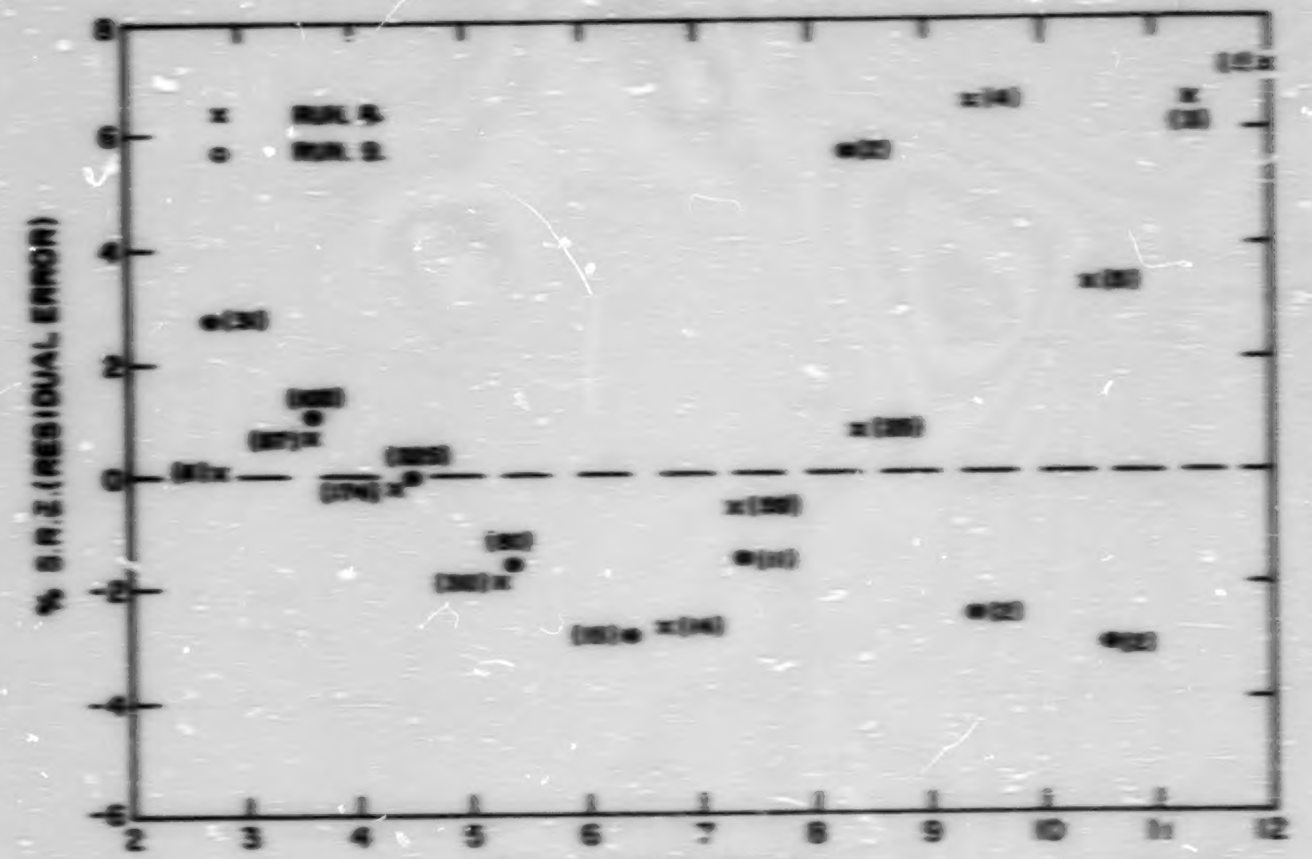


FIG. 35.

% S.R.E.(RESIDUAL ERROR) VERSUS BED SULPHATE (WT.%)

(RUNS 8 AND 9)

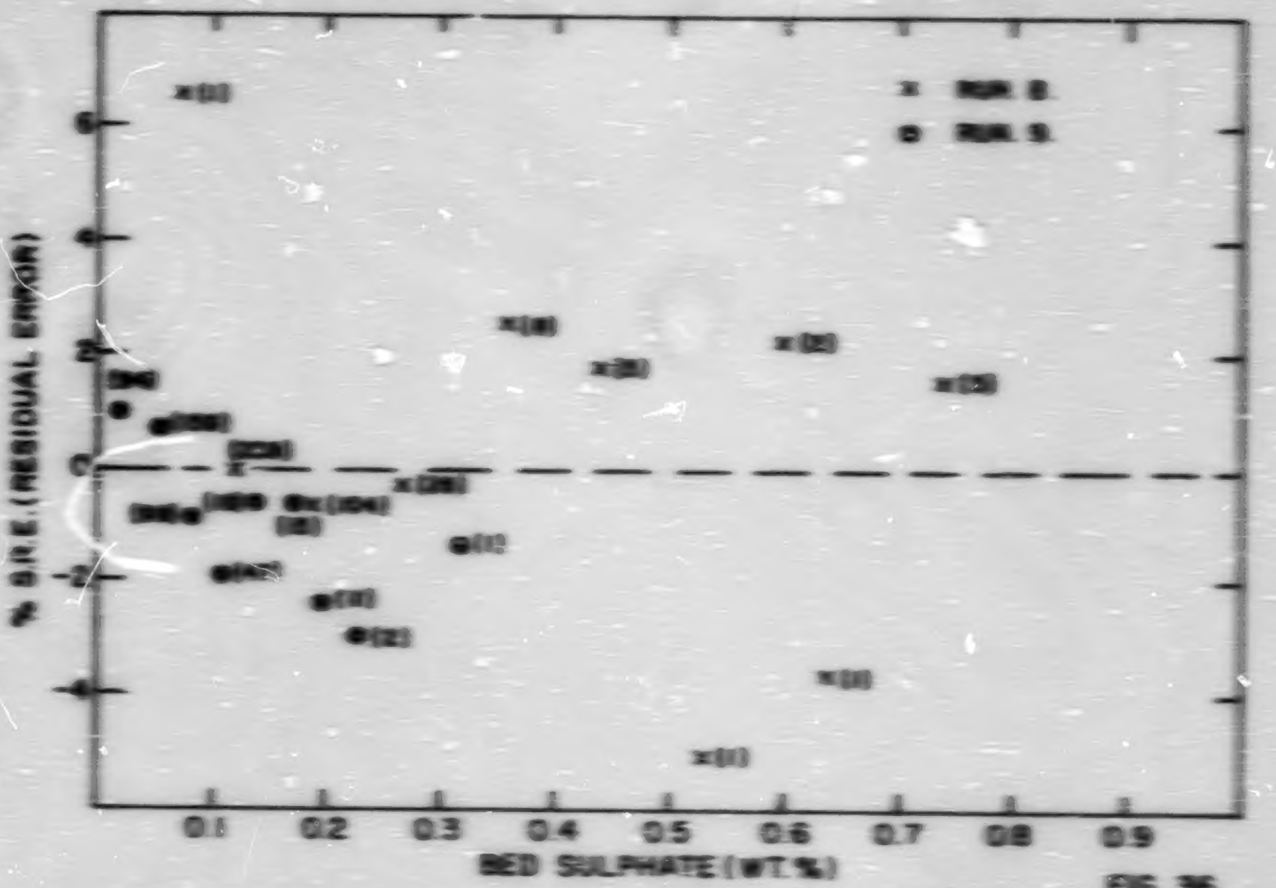


FIG. 36.

% SRE (RESIDUAL ERROR) VERSUS BED CARBON (WT.%)

(RUNS 8 AND 9)

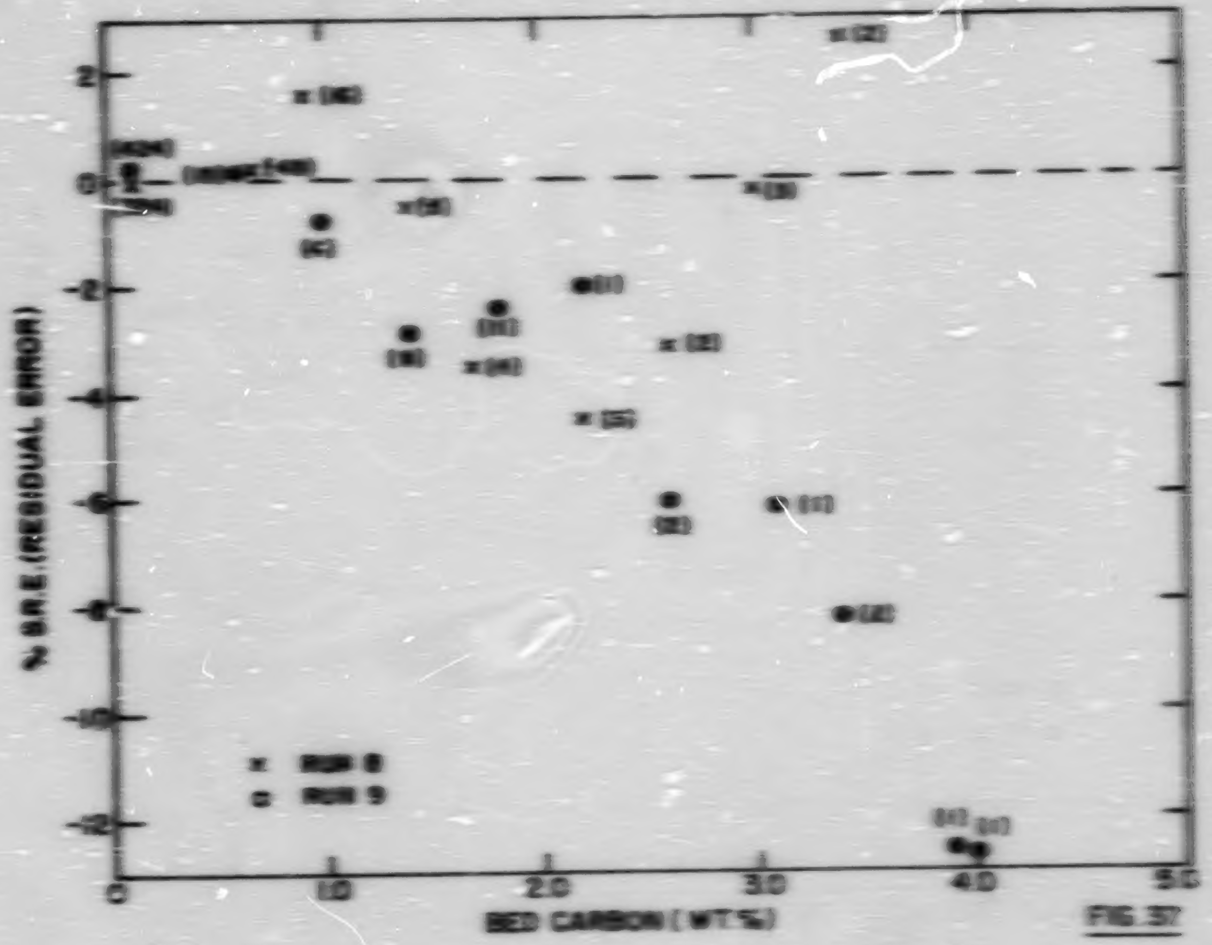


FIG. 37

Bed Sulphur (wt%) - Throughout Runs 8 and 9 the bed sulphur level varied over the range 3-12 wt% whereas previous results for Runs 6 and 7 were restricted to a maximum level of 6 wt%. Fig. 35 shows a definite trend towards a reduction of desulphuring performance with high bed sulphur levels for Run 9 but this is not borne out by the Run 8 results which indicate the opposite. Interpretation is obviously made difficult by the limited number of data points at high bed sulphur levels and further tests are needed to identify the effect of this variable.

Bed Sulphate (wt%) - Figure 36 shows that up to 0.8 wt% sulphate levels the % S.R.E. remains unaffected. The indications from start up results after sulphation are that performance is affected at high sulphation levels but within the range 0-0.8 wt% no detectable effect is noted.

Bed Carbon (wt%) - Figure 37 shows the results obtained with bed carbon as a variable. Unlike the other variables, a definite trend downwards particularly for Run 9 data is evident from the graph. This indicates that at high levels of bed carbon, sulphur removal performance is impaired. However, at the present time a question-mark hangs over the precision of the method used to analyse carbon levels on limestone and consequently this variable has not been incorporated into the regression equation.

Applying the Regression Equation to Earlier Runs -

Previous runs have been analysed in a different manner and obviously these runs warrant re-analysis in the light of the apparent success of the new approach. As a preliminary step, the equation has been used to predict the desulphurising performance of Run 6 and 7. Table 20 shows the results of this analysis for the ten hourly average readings of % S.R.E. Unfortunately, the cyclone drain temperatures for this earlier runs are not comparable with Runs 8 and 9 due to equipment changes. Furthermore, the bed depths recorded in Runs 6 and 7 were approximately half that of the later runs. Since bed depth and fines circulation (cyclone temperature) are loosely correlated this would suggest a lower contribution from this variable. However, this was compensated by a smaller free-board space above the bed. As a first approximation therefore the mean value of cyclone drain temperature for Runs 8 and 9 was taken as consistently applicable to the earlier runs.

TABLE 20

Prediction of Averaged % S.R.R. from Runs 6 & 7 Using Developed Equation for Runs 8 & 9

Run No	Time of First Reading	Actual % S.R.R.	Predicted % S.R.R.	Difference
7	4.0630	77.5	71.1	6.4
7	5.0230	80.0	71.5	8.5
7	6.1830	67.5	69.4	-1.9
7	7.1430	67.5	71.0	-3.5
7	9.2130	70.0	71.2	-1.2
7	11.0930	78.0	74.0	4.0
7	13.0030	81.0	77.4	3.6
7	13.1530	80.0	72.3	7.7
7	14.1630	77	72.2	4.8
	MEAN	75.4	72.2	3.2
6	2-0830	75.5	63.7	11.8
6	3-0430	80.0	66.7	13.3
6	6-2230	80.0	67.7	12.3
6	8-0430	71.5	61.5	10.0
6	9-0030	71.5	62.4	9.1
6	11-0630	84.0	70.4	13.6
6	12-2030	82.0	63.1	18.9
6	15-1330	82.0	60.0	22.0
6	16-1930	71.5	65.3	6.2
6	19-1730	78.5	58.4	20.1
	MEAN	77.7	63.9	13.8

Good agreement between the predicted and actual % S.R.E. for Run 7 has obviously been obtained but the observed results for Run 6 are much better than predicted. This is an important observation since detailed analysis of this run may reveal the factor responsible for this superior performance.

Use of Aragonite -

Throughout Runs 8 and 9, BCR 1359 limestone was exclusively used except for two short periods in Run 9 when Aragonite stone was used. During the periods of operation on Aragonite, analysis of the flue gas SO_2 was made difficult by the tendency of the stone to quickly reduce to powder form and to coat the sample line filter resulting in erroneous SO_2 readings. Because of this, the periods of Aragonite use were eliminated during data editing (see Appendix H) and hence the mathematical equation was developed entirely from experimental data using BCR 1359.

To compare the effect of the two limestones on sulphur removal efficiency the results were analysed in the following way:-

(1) The average % S.R.E. values for the Aragonite periods were compared with average values for BCR 1359 for periods immediately before and after Aragonite use.

(2) The developed mathematical equation for BCR 1359 stone was used to predict the average values for Aragonite.

Table 21 shows the results of this analysis together with a sulphur balance for the periods under review. As expected, the predicted values for the periods of BCR 1359 use compare well with the actual values but the actual values for Aragonite use are superior to those predicted by the equation.

The important question is whether this apparent improvement is due to the quality of limestone or due to inaccuracy in the measurement of flue gas SO_2. In this respect the sulphur balances of Table 21 are revealing. The % Sulphur Imbalance is a measure of the amount of sulphur not accounted for during that period of operation. In the case of the BCR 1359 periods, on average about 11% of the sulphur remained unaccounted for whereas for the Aragonite periods this increased to about 23%. The implication of this is that in fact the performance of the two stones was similar and the apparent superior performance of Aragonite was due to the powdered stone coating the sampling filter and giving artificially low readings for flue gas SO_2.

TABLE 21

Effect of Aragonite on % S.R.E.

Test Period Run 9	Stone	Mean %SRE (Actual)	Mean % SRE (Predicted)	Sulphur Balance Sulphur In (kilomols)	 In-out (kilomols)	 % Imbalance
19.1230-19.2230	BCR 1359	83.5	82.4	1.07	0.13	12.1
19.2330-20.0830	ARAGONITE	87.7	81.2	1.08	0.23	21.3
22.1030-22.1930	BCR 1359	82.2	82.5	1.04	0.27	26.4
31.1030-31.1930	BCR 1359	74.2	72.5	1.04	0.08	7.7
31.2030-32.0830	ARAGONITE	84.5	76.3	1.31	0.32	24.4

Injection of Sulphur Compounds and Steam into Gasifier Bed -

During Run 9 various sulphur compounds were injected directly into the gasifier bed whereas during Run 8 steam was introduced by injecting it into the plenum air.

Sulphur Compounds - Table 22 shows the effect of injecting H_2S, SO_2 and thiophene into the middle of the bed through a central tapping. The rate of sulphur injection from these additives corresponded to approximately 25% of the total sulphur added via the fuel during the period of injection.

Throughout the period when both SO_2 and H_2S were injected, the level of flue gas SO_2 remained unaltered indicating that the injected material was completely absorbed by the bed. However, in the case of thiophene the percentage increase in the flue gas SO_2 level was exactly the same as the percentage increase in total sulphur added to the bed indicating that the sulphur removal efficiency for this additive is identical to the efficiency of removal of fuel sulphur.

Steam - During the period 7.1630 to 8.0030 of Run 8 steam was injected into the plenum air to assess the effect on % S.R.E. At the same time flue gas recycle was reduced to compensate. The observation at the time of the experiment was that flue gas SO_2 levels increased and indeed added water whether by steam injection, water saturated flue gas recycle or emulsion of water in the fuel has been shown to detrimentally affect performance. In fact, the results during the period of steam injection were treated in the normal way for added water and contributed to the data used to develop the regression equation.

Experiment with Movable Fuel Injector -

At the end of Run 8 a short experiment was carried out using the bottom fuel injector to try to determine the effect of bed depth on % S.R.E. in isolation of the other process variables. The bottom fuel injector was progressively moved up through the bed effectively changing the bed depth available for desulphurising the fuel.

Unfortunately, the experiment was not as simple as first envisaged and this was indicated by the fact that the temperature of the bed increased progressively as the injector

TABLE 11

Effect of Injecting Various Sulphur Compounds Into the Gasifier Bed

Compound	Time of Injection	Rate of Injection (lb/hr)	Fuel Sulphur Rate (lb/hr)	% of Total Sulphur from Additive	% Change in Flue Gas SO_2	% S.R.R. of Fuel Sulphur	% S.R.R. of additive
H_2S	17-1205 & 17-1605	3.5	10.1	25.9	0	60	100
CS_2	17-2025 & 17-2045	3.5	11.7	23.0	0	73	100
C_4H_4S (thiophene)	27-2130 & 27-2300	7.6	7.9	25.0	25.0	83.8	86.0

moved up through the bed. The results of this study are presented in Table 23. At the maximum travel of the injector ('effective' bed depth 45.5 cm) readings at two different bed temperatures are recorded. In order to obtain the lower temperature reading, the air flow had to be reduced. Predicted values of % C.E.R. were obtained from a regression equation using bed depth and bed temperature as the only independent variable. These together with the regression equation are also given in Table 23.

The main point to note is that the correlation coefficient for bed depth obtained in this analysis compares closely with that produced from the regression analysis of the bulk data. The adverse effect of bed temperature, however, is markedly higher and this warrants further study.

TABLE 21

Effect of Position of Bottom Fuel Injector on % S.R.E.

Movement (cm)	Effective Bed Depth (cm)	Bed Temperature (°C)	% S.R.E. (Actual)	% S.R.E.+ (Predicted)
0	93	897	78.9	77.6
5	88	903	74.6	75.3
47.5	45.5	945	51.5	53.4
47.5	45.5	915	62.8	62.7
5	88	902	74.8	75.6

+ % S.R.E. = 0.22 × Bed Depth (cm) − 0.3 × Bed Temperature (°C) + 349.2

Retention of Trace Elements

In addition to a high sulphur content, heavy fuel oil contains several other elements which can also be captured by the CAFB process. Previously reported work (2) indicated 100% retention of vanadium, 34% retention of sodium and 75% retention of nickel on the gasifier bed material. This work was carried out during Run 5 of the continuous unit and applies to both BCR 1691 and Denbighshire stone. No measurable difference in the ability of these stones to capture trace elements was identified but the BCR 1691 was subject to severe attrition, and high dust losses from the system (~40%) were observed.

Retention of trace elements by the CAFB process is important for several reasons. Firstly these elements may be pollutants in their own right and any process which reduces their emission is desirable. Secondly, elements like vanadium are a major cause of boiler corrosion and removal of this material from the boiler fuel should alleviate this problem. Finally, enrichment of the bed material may be sufficiently high to enable the spent bed material to be used as an extractable ore eg. recovery of vanadium apparently becomes commercially viable above 2 wt% on spent stone. This would provide an attractive solution to the problem of spent lime disposal.

To investigate the retention of trace elements by BCR 1359 the period of gasification 10-1630 to 13-0030 for Run 9 was selected for more detailed analysis. Throughout this period the unit operated comparatively trouble free with a more or less constant bed level, stone and fuel feed rates. The important operating conditions for this analysis are given in Table 24.

Table 24

Operating Conditions for Period 10-1630 to 11-0130 for Run 2

Gasification time:- 57 hours
Total feed oil supplied:- 9670 kilograms
Total stone feed (calcined):- 421.5 kilograms
Total stone recovered (calcined):- 393.4 kilograms
Total bed material (calcined):- 422 kilograms

Gasifier bed temperature:- 910 ± 10°C
Gasifier bed depth :- 117 ± 2 cm
Ca/S mole feed rates :- 0.95 ± 0.1

Maximum Enrichment Factor:- 20.6

This shows the total stone addition to the gasifier during this period was equal to the complete bed weight and therefore the period under review (57 hours) represents the residence time in the bed of an average particle of bed material. The ratio of the total fuel supplied to the total stone supplied (measured as calcined material) gives the maximum enrichment factor assuming 100% retention. This implies that with a homogenous distribution of the trace element on the bed stone, the maximum enrichment at a one mole feed rate is approximately twenty times the level in the fuel. In the case of the vanadium for example at a level of 300 ppm in the fuel the maximum concentration would be ~6000 ppm. In order to achieve bed concentrations of ~2% vanadium an enrichment factor of about sixty six is required implying a feed rate of about 0.3 molar.

Table 25

Stone Inventory for Gasification Period 10-1630 to 12-0030 for Run 9

Location	Equivalent Burnt Stone (Kilograms)
Elutriator Coarse	159
Elutriator Fines	41
Boiler (back and flue)	116.8
Regenerator Cyclone	19
Gasifier (samples)	16.2
Regenerator (samples)	21.3
Bed depth correction	10.8
Total stone recovered	383.4
Total stone feed	421.8

Table 25 shows the stone inventory for the gasification period under review. Approximately 9% of the stone was not accounted for which compares favourably with the overall stone balance for the run which shows a 13% deficit. Assuming that no bed sampling or recovery of material from the elutriator coarse was carried out, it is possible from table 25 to assess the minimum stone feed rate needed to maintain a constant bed depth. Because stone losses to the boiler were high due to inefficient cyclone operation, a feed rate of 0.5 molar was required simply to maintain bed level. More efficient first stage cyclones should allow lower feed rates to be possible and hence higher trace element enrichment factors.

Trace Element Analysis

Analysis of the trace elements for this study was carried out by the Analytical R & D Unit, A.E.R.E. Harwell, England. Samples of the various exit streams from the gasifier were taken at midnight on day 12 of Run 9 and analysed by Spark - Source Mass Spectrometry. The detailed results are presented in Appendix G, table XVI. Samples of the fuel oil and fresh limestone were also analysed by this technique (Appendix G) and for comparison, by Neutron Activation Analysis.

Mass Spectrometric survey analyses normally cover most elements in the Periodic Table from boron to uranium, with the exception of carbon, nitrogen, oxygen, tantalum and those elements which are subject to interferences. The accuracy of this technique is usually accepted as being "x3" each way. That is to say, the true concentration of an element probably lies within the range from one-third of the observed value to three times that value. For this reason results are normally presented in the form of a 'probable range' covering one order of magnitude. Where interference is known to occur, or is seriously suspected, the upper limit of the calculated range is reported as a maximum concentration, followed by the letter 'I' to indicate interference. Where interference is noted it is possible that the element is not actually present in the matrix and the concentration may be zero. Consequently, a survey analysis of this type should be considered as a useful guide to the approximate concentration of a large number of element, but specific analyses are recommended for those elements of particular importance.

The results of Neutron Activation Analyses of fuel oil and fresh limestone are presented in Appendix G Table XV. A comparison of the results for several trace elements by the two analytical techniques is shown in Table 24. The agreement in the case of fuel oil vanadium concentration is particularly good but for some of the other elements the agreement on the whole is rather poor.

Table 26

Comparison of Analytical Results from Spark-Source Mass Spectrometry and Neutron Activation Analysis

	Fuel Oil		Limestone	
Trace Element	Neutron Activation Analysis (ppm)	Spark-Source Mass Spectrometry (ppm)	Neutron Activation Analysis (ppm)	Spark-Source Mass Spectrometry (ppm)
Vanadium	300,280	100-1000	3.5, 5	0.06-0.6
Cadmium/ Indium	7	<0.1	29	<6
Cobalt	0.2	0.1-1.0	0.3	<20
Chromium	1.4	0.02-0.3	2	<20
Molybdenum	<10	0.1-1.0	*	<2
Manganese	0.9	0.06-0.6	22	6-60
Nickel	<5	6-60	<50	<6
Antimony	<2	0.01-0.1	<20	<0.3
Tellurium	<1	<0.006	2	<0.6

Trace Element Recovery

In view of the high degree of inaccuracy of the analytical techniques, conclusions regarding the retention of trace elements must of necessity be tentative. The approach taken here is to accept the levels generated by spark-source mass spectrometry as the best estimate and see what conclusions this leads us to. Important observations can then be subjected to further more detailed analysis.

Mass balances of the period 10-1630 to 13-0030 for trace elements of particular importance are shown in Table 27.

Table 27

Mass Balances for Gasification Period 10-1630 to 13-0030

Trace Element	From Fuel (g)	From Stone Feed (g)	Total in (Fuel + Stone) (g)	Total out (stone recovered) (g)	% Retention by system
Beryllium	<0.1	<1.5	<1.6	<1.5	-
Cadmium	<0.5	<0.2	<0.7	<0.2	-
Antimony	<0.3	<0.2	<0.5	0.5	-
Molybdenum	3	<1.4	<4	~8	~200
Nickel	173	<4.5	~178	207	116
Vanadium	2601	<0.2	2601	2392	92
Tellurium	<0.05	<0.6	<0.6	<0.6	-
Arsenic	8.7	<4.5	9-13	4.2	47-32
Selenium	<0.5	<2.3	<2.8	1.1-1.6	-
Chromium	<0.5	<15	<15	<4	-
Manganese	2	14	16	10	63
Cobalt	3	15	18	24	133
Boron	<0.01	<4.5	<4.5	<3.3	-
Lead	9	2	11	23	207
Sodium	52	23	75	82	110
Potassium	9	226	235	233	99

The concentrations of Beryllium, Cadmium, Antimony, Tellurium, Selenium, Chromium and Boron were too low for meaningful balances to be obtained, and the concentration of Mercury both in the stone and the fuel was below detectable level. It is necessary to establish whether at these potential pollutant levels, there would be any merit in further more detailed analytical study of retention of these elements on the CAFB bed. The major contaminants in fuel oil appear to be fully retained within the system. Indeed the results in Table 27 indicate with the exception of Arsenic and Manganese that the majority of trace elements are retained in the system. This of course neglects the 7% dust losses which will obviously contain trace elements and is subject to the accuracy of the analytical data.

For the period of operation under study the maximum enrichment factor has been calculated as 30.6. Table 28 shows the enrichment factors in the gasifier bed material and boiler cyclone fines for various trace elements.

The values for the gasifier bed material are considerably lower than expected assuming 100% retention whereas the enrichment of the boiler cyclone fines are considerably higher. This implies that the assumption of homogenous distribution on the lime is incorrect and that the trace elements are preferentially laid down on the finer particles in the bed. Alternatively, the elements volatilise from the bed and condense on the fine particles in the boiler cyclone. This is an important observation which obviously warrants further study since the previously reported retention levels of Vanadium, Nickel and Sodium were derived from gasifier bed material concentrations assuming homogenous distribution on the lime.

The picture becomes somewhat complex when the trace element level on the original stone is high compared with the level formed in the fuel. The enrichment factors quoted in Table 28 are calculated assuming the trace element concentration derived from the original stone remains constant throughout the process. However, at least in the case of potassium and manganese this is obviously not the case and an apparently negative enrichment factor is obtained indicating migration of these elements from the gasifier bed material to the boiler cyclone fines.

Further work is clearly necessary to establish the mechanism and significance of this migration.

Table 28

Comparison of Trace Element Enrichment Factors on Gasifier Bed Material and Boiler Cyclone Fines

Trace Element	Enrichment Factor - Gasifier Bed Material	Enrichment Factor - Boiler Cyclone Fines
Vanadium	6	30
Nickel	9.4	100
Molybdenum	~4	180
Cobalt	~0	480
Lead	~0	195
Manganese	≈70	140
Sodium	3	36
Potassium	≈505	1300
Arsenic	~0	~8

Materials of Construction

The following materials were used for the internals of the C.A.F.B. units and were exposed to the process conditions:

Refractories: Durax C1600 (G.R. Stein)
Durax 1500GM (Gunmix No.1) (G.R. Stein)
Durax C1850 (G.R. Stein)
Greencast 94 (A.P. Green)

Fireclays and sealing materials: - various

Ceramics: Self-bonded SiC (British Nuclear Fuels)
Self-bonded Si_3N_4 (Advanced Materials Engineering)

Metals: 18/8 stainless steel (various suppliers)
Type 310 stainless steel (various suppliers)
Type 321 stainless steel (various suppliers)
[illegible] Blue (Land Pyrometers)

In addition to the above, calcium silicate slab and Amberlite 75 (both from G.R. Stein) which were used as insulating refractories, were exposed to process and regeneration gases and to vapour phase tar which permeated through cracks in the hot face refractory.

According to the original proposal (Task 6) we were to test up to 10 materials of construction as requested by EPA or EPA Contractors. We did not in fact receive any requests to test particular materials; the only tests carried out were therefore such as were necessary to ensure that the materials used in the pilot plant were satisfactory for that purpose. These were locally available materials which may or may not be readily available in U.S.A.

The description of composition (where appropriate) and performance follows:

(i) Durax C1600
This was a general purpose hot face refractory suitable for reducing gas conditions, supplied by:

GR-Stein Refractories Ltd.,
Monolithics Division,
Sheffield, U.K.

Typical compositions:

Al_2O_3	49.85
SiO_2	40.85
Fe_2O_3	0.78
TiO_2	0.18
CaO	4.75
Alkalis	0.54

Refractoriness = +1730°C
Continuous service limit = 1550°C

This was the main refractory used for the monolithic construction of the continuous unit and for lining the batch units. In the continuous unit the refractory endured over 3000 hours of on-stream gasification, plus about 2000 hours of high temperature operation under combusting or burn-out conditions.

The hot face became rough and lightly eroded on the three faces adjacent to outside walls of the unit but there was considerable erosion on the face adjoining the regenerator where patches were eroded to the depth of ½-1" at a height of 3-5 ft up from the distributor. There was a severe crack between the gasifier and regenerator (3/16" to 1/4" at the widest point and 3 ft long) which was probably closed at the operating temperature. The inside of the regenerator was severely eroded, especially in the lower 3 ft where there was severe pitting and the refractory was soft and friable.

(ii) Duran 1500 GH (Gummix No.1)
This is a fine grain high alumina high grade refractory also supplied by GH-Stein.

Composition:

SiO_2	6.45%
Al_2O_3	76.2%
Fe_2O_3	5.16%
TiO_2	3.46%
CaO	5.32%
Alk.	0.07%

Refractoriness = +1700°C
Continuous service limit = 1450°C

This material was used to line the early batch units and gave a satisfactory performance over several hundred cycles, gradually acquiring longitudinal cracks.

(iii) Durax C1850

This is a tabular alumina refractory cement also supplied by GR-Stein with the following typical composition:

SiO_2	0.06%
Al_2O_3	96.8%
Fe_2O_3	0.07%
TiO_2	trace
CaO	2.70%
MgO	0.06%
Alk.	0.11%

Refractoriness = +1800°C
Continuous service limit = 1800°C

This material was used to line the cyclones in the continuous unit after C1600 was found to be inadequate for that purpose. The top lift of the regenerator was also cast in this material. After exposure to process conditions for 1000 hours the cyclones and top of the regenerator were both in excellent condition.

(iv) Greencast 94

This material was similar to C1850 in composition and properties but from

A.P. Green Refractories Ltd.,
Dock Road,
Bromborough,
Merseyside, U.K.

It was used for batch unit distributors and was satisfactory.

(v) Self-bonded Silicon Carbide

This was an experimental material containing no binder, developed by the United Kingdom Atomic Energy Authority and supplied to us by British Nuclear Fuels Ltd.

We used this material for cyclone offtakes, liners for the cyclone drains, liner for the fines return duct, an extension spacer to deepen the regenerator and as the central pipe in the batch burn-back test burner. After considerable exposure to process conditions no deterioration was noticed.

(vi) Self-bonded Silicon Nitride

This material, on paper, showed great promise as a more easily machineable and cheaper alternative to silicon carbide. Unfortunately it disintegrated completely in the presence of calcium ions and therefore could not be used in this process.

(vii) 18/8 Stainless Steel
Was used for making the internal cyclones in the batch units. The 16-gauge material burnt out every 10 to 20 batch runs, despite the low top temperature (~600°C) in the batch units. It was also used for making the regenerator distributor, for which it was satisfactory.

(viii) Type 310 Stainless Steel
This was used for oil lances for which it was suitable most of the time. It was also used for the top burn-out connection and for the steam/N_2 injection pipe. It was satisfactory for both applications.

(ix) Type 321 Stainless Steel
This was used for distributor air nozzles and for this purpose it was satisfactory.

This metal was also used as a liner in the cyclone drain line and also for the cyclone offtakes, both plain and steam cooled. The cyclone drain liners suffered from severe sulphide attack; the plain cyclone offtake burned out quite rapidly; the steam cooled cyclone offtake lasted out a test run but was showing signs of severe corrosion at welds after 200 hours.

(x) Firebird Blue
This metal is a 27% nitrided chrome iron supplied by:

Land Pyrometers Ltd.,
Dronfield,
Sheffield, U.K.

It was used successfully for oil injectors, pressure tappings and thermocouple sheaths. The thermocouple sheaths in the regenerator (particularly if the regenerator temperature was high) were occasionally very brittle. Satisfactory for use inside the gasifier, e.g. thermocouple sheaths, etc.

(xi) Calcium silicate slab insulation
Was in very good condition with no sign of compression or disintegration.

(xii) Amberlite 75
This was a vermiculite based insulating refractory and performed well but shrank away from the hot face refractory in places, especially in areas which were discoloured indicating contacting with product gas. The shrinkage appeared to be largely that of the vermiculite matrix, indicating that a perlite based insulation may be preferrable.

(xiii) Fireclays and sealing materials
A number of different fireclays were used for patching, filling in cracks and sealing joints:

Air setting fireproof cement: (from GR-Stein) was used, in conjunction with asbestos rope for filling in gaps around the gasifier and regenerator lid. It was very satisfactory.
Fireclay: (from GR-Stein) was also used for lid and distributor seals, in conjunction with asbestos rope. It was quicker setting than the air setting cement and was satisfactory.
Sairset: (from A.P. Green) was the most versatile of the various fireclays. It has been used for lid and distributor seals, for filling in refractory cracks and for sealing leaks during the test run. It was very satisfactory.
Asbestos rope: soft with woven outside cover was used for sealing mating refractory surfaces and gave satisfactory performance, particularly when backed up with fireclay. Such joints would hold 2-3 psi pressure across a 1/8" (3mm) sealed gap while allowing some thermal movement.
Fibrefrax paper and blanket: this material, supplied by

The Carborundum Co. Ltd.,
Mill Lane,
Rainford St. Helens,
Lancashire, U.K.

was also used as a refractory joint seal, backed up by a fireclay. The joints were satisfactory but allowed little movement and tended to break down if the thermal movement was excessive. Excellent as high temperature insulation.

Summary

Refractories: Durax C1600 and Durax 1500GM were both satisfactory for gasifier hot face use. Durax C1600 was not suitable for long term use as regenerator lining material.

Durax C1850 was excellent for cyclone, regenerator top and gasifier hot face construction. Greencast 94 was excellent for refractory distributors.

Ceramics: Self-bonded silicon carbide was excellent for cyclone offtakes, cyclone drains, fines return line and regenerator bottom hot face. It showed no deterioration in use whatsoever.

Self-bonded silicon nitride disintegrated under C.A.F.B. conditions and must not be used for internal construction.

Metals: 18/8 and 321 S.S. were suitable for distributor air nozzles in regenerator and gasifier, respectively. 310 S.S. has been used for oil injectors with satisfactory results. In general the stainless steels cannot be used uncooled inside the gasifier or the regenerator. Firebird Blue was satisfactory for uncooled (e.g. thermocouple sheaths) or cooled (e.g. oil injectors) applications inside both the gasifier and the regenerator, provided it was not overheated.

Fireclays and seals: The various fireclays and sealing materials were all satisfactory, Hairset was the best all round fire-clay and asbestos rope the best high temperature gasketing material.

Modifications to Equipment and Operations

The various modifications to the equipment, carried out in order to achieve a particular set of operating conditions or to attempt an improvement of faulty equipment, are described in detail in Appendix E. The results achieved by these modifications are briefly discussed below.

Run 8

(i) Bed velocity and depth - The gasifier bed area was reduced for this run so that the gasifier could be operated at higher bed velocities without overloading the boiler. The total height of the gasifier bed was also increased so that deeper beds could be used without overloading the cyclones with solids. The cyclones themselves were re-cast from a finer-grained, high alumina refractory and also the cyclone drains and fine return system was improved so that it should have been able to cope with a larger load of fines. During Run 8 the unit was operated at up to 6 ft/sec. (1.83 m/sec.) bed velocity and up to 56 inches (1.42m) bed depth but for short times only because, despite the modifications, the cyclone drain and fines return system could not cope with the larger load of fines. Equipment problems associated with the fines return system were identified and were remedied in time for Run 9. In Run 8, however, continuous and prolonged operation with a deep bed at a high bed velocity was not possible.

(ii) Water and Steam - Provision was made to inject an oil/water emulsion into the bed through the bottom injector. This equipment was not used because we received (unknowingly) a supply of wet oil and were therefore obliged to inject a water/oil emulsion anyway for several days producing rather more data on an emulsion operation than originally intended. A steam connection to the plenum enabled gasification with an air/steam mixture, replacing flue gas with steam as an internal coolant. A short test of air/steam gasification was successfully carried out giving a comparison of steam v water (in emulsion) v flue gas as coolants.

(iii) On stream burn-out - A steam injection point in the side of the gasifier above the bed and air injection nozzles in the lid was used for an attempt on an on stream burn-out of carbon from the cyclones.

In theory, if the total injected oxygen should be above about 33% of stoichiometric combustion requirement then, instead of depositing carbon, removal of carbon by gasification should take place. Injection of such a high quantity of air under the lid would have caused an unacceptably high back pressure but injection of a smaller quantity of air as a stratified layer should have given some carbon removal, with the steam injected through the side acting as a temperature moderator. In the event, at an air injection rate of 12.5 scfm (350 l/min) of air and 0.9 lb/min (0.4 kg/min) of steam there was no reduction in back pressure indicating no significant removal of carbon and the test was discontinued after several hours.

(iv) Bottom injector scan - The gasifier monolith was raised 10" to allow about 20" vertical movement of the bottom injector. A test was therefore carried out, just before the end of Run 8, in which the bottom injector position was varied keeping all other operating variables constant. The results were very interesting in that the change in sulphur removal efficiency (S.R.E.) with depth of injector immersion followed the same relation as the change in S.R.E. with bed depth with oil injection at a constant level, indicating that oil should be injected as low in the bed as is practically possible.

(v) General comments - Because of asymmetric positions of cyclone inlets, the quantity of stone going to the two cyclones was different although it probably did not affect the performance. Fines were returned to the gasifier in slugs which lowered temporarily the gasifier temperature and caused sudden increases in the stack SO_2 content.

Run 9

(i) Cyclone drains and fines return - Modifications to the cyclone drains and fines return system included improvements to all identified problem areas and indeed the performance of the system was greatly improved. There were, however, frequent blockages at the bottom of the cyclone drains caused by the condensation of vapour phase tar, blockages in the pressure sensing lines, and the system failed to cope with the circulation of solids above a certain rate, indicating that either the solids transfer pipework needed to be increased in size or that the whole system needed to be modified since it restricted our capability of exploring a wider range of operating conditions. One successful improvement was the puffer on the fines return system, which was intended to spread out the slugs of fines into a fairly continuous return, and which worked very well.

(ii) On stream burn-out - Air was injected under the lid at rates of up to 53 scfm (1500 l/min) and at times it appeared to arrest the increase in the back pressure caused by coke laydown. However, at no time did it give any indication of removing carbon. The air injection system itself worked perfectly.

(iii) Slumped bed burn-out - Provision was made to inject nitrogen into the gasifier plenum during a shut down, thus inerting the gasifier bed and burn-out of the carbon above the bed without having to sulphate. This procedure was tried using:

Air/steam
Air/nitrogen
Air/flue gas
Air - injected for a short duration followed by a cooling down period.

All were successful at a nitrogen bleed rate through the bed of only 1 scfh/ft^2 of bed. There was no sign of any agglomeration, slagging or overheating of the gasifier bed and in each case gasification commenced within seconds of initiating oil injection.

(iv) Injection of sulphur compounds - H_2S, SO_2 and thiophene were injected for short periods into the gasifier bed. H_2S and SO_2 were totally absorbed while the thiophene was decomposed and absorbed to the extent of about 80%. This verified the assumption that only thiophenic sulphur compounds are stable enough to survive a passage through the gasifier.

(v) General comments - The gasifier, some of its ancilliaries and most of the analytical equipment were showing definite signs of old age during this test run, which exhibited themselves in an excessive number of shut downs, many of them triggered by maloperation or failure of detectors or alarm circuit components. However, the succession of shutdowns did prove the efficiency of most of the safety systems on the pilot plant, and also demonstrated that plant shutdown and restart on gasification could be achieved simply and in safety with a minimum of training for operating staff.

SECTION VI

APPENDICES

APPENDIX A

Batch Tests on Limestones and Fuels

		PAGE
Table AI	Kerosine Combustion Tests.	120
Table AII	Fuel Oil Combustion Tests.	121
Table AIII	Fuel Oil Gasification Tests.	122
Table AIV	Cyclic Tests - Amuay Fuel/Aragonite.	123
Table AV	Cyclic Tests - Vacuum Pipestill Bottoms/Aragonite.	124
Table AVI	Cyclic Tests - Amuay Fuel/Tymochtee Dolomite.	125
Table AVII	Cyclic Tests - Amuay Fuel/BCR 1359.	127

TABLE XI [illegible] COMBUSTION TESTS

[illegible]	[illegible]				[illegible]			
TIME HR.	BED DEPTH METERS	BED SPECIFIC GRAVITY	CYCLONE DUST g	BED TEMP. °C	BED DEPTH METERS	BED SPECIFIC GRAVITY	CYCLONE DUST g	BED TEMP. °C
0	0.53	0.71	-	890	0.37	1.0	-	910
½	0.51	0.75	275	890	0.37	1.0	266	960
1	0.47	0.75	257	880	0.36	1.0	100	870
1½	0.42	0.76	151	892	0.34	1.0	400	870
2	0.42	0.78	101	880	0.33	1.0	60	885
2½	0.41	0.78	90	907	0.33	1.0	51	890
3	0.42	0.75	46	908	0.33	0.96	55	890
3½	0.41	0.77	45	900	0.33	0.96	24	900
4	0.41	0.77	45	890	0.32	0.90	29	900

[illegible] FUEL OIL CONVERSION TESTS

[illegible]	[illegible]					[illegible]				
TIME HR.	BED DEPTH INCHES	BED SPECIFIC GRAVITY	CYCLING [illegible] %	BED TEMP. °C	FUEL RATE g/min.	BED DEPTH INCHES	BED SPECIFIC GRAVITY	CYCLING [illegible] %	BED TEMP. °C	FUEL RATE g/min.
0	0.54	0.71	-	860	-	0.57	0.67	-	900	-
½	0.46	0.75	285	850	49	0.59	0.65	352	880	54
1	0.46	0.75	347	850	53	0.55	0.67	255	860	50
1½	0.42	0.75	316	870	51	0.55	0.67	110	900	52
2	0.41	0.75	275	880	53	0.50	0.71	-	880	54
2½	0.39	0.75	297	910	53	0.50	0.70	-	850	57
3	0.37	0.75	250	910	58	0.50	0.70	168	895	42
3½	0.37	0.75	197	910	46	0.49	0.70	-	850	42
4	0.36	0.75	200	940	51	0.45	0.70	196	880	42

TABLE XIII FUEL OIL [illegible] TESTS

[illegible]	[illegible]					[illegible]				
TIME HR.	BED DEPTH METRES	BED SPECIFIC GRAVITY	CYCLONE DUST g	BED TEMP. °C	FUEL RATE g/min.	BED DEPTH METRES	BED SPECIFIC GRAVITY	CYCLONE DUST g	BED TEMP. °C	FUEL RATE g/min.
0	0.46	0.83	-	825	-	0.51	0.75	-	810	-
½	0.45	0.79	397	860	220	0.51	0.75	258	840	225
1	0.43	0.83	350	850	207	0.51	0.75	109	850	208
1½	0.40	0.83	186	855	238	0.49	0.75	-	870	219
2	0.40	0.83	135	850	235	0.49	0.75	201	880	215
2½	0.37	0.83	90	865	242	0.50	0.71	65	880	197
3	0.36	0.83	74	838	246	0.50	0.71	44	892	211
3½	0.34	0.83	43	838	246	0.50	0.71	20	870	211
4	-	-	-	-	-	0.50	0.71	75	880	207

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APPENDIX B

Burn-back Burner Test Results

Contents Page

Burn-out Gas Analyses and Gasifier Duct Temperatures

Table B-I Run 3 129
Table B-II Run 5 130
Table B-III Run 6 131
Table B-IV Run 7 132
Table B-V Run 8 133
Table B-VI Run 9 134

Batch Gasifier Operating Conditions

Table B-VII Runs 1-5 135
Table B-VIII Runs 6-9 136
Table B-IX Runs 10-14 137

Burn-back Burner Combustion Tests 138
Model for Prediction of Flue Gas Analyses 140

Table B-X Operating Conditions 143

Gas Velocities, Primary Aeration and Flue Gas Analyses

Table B-XI Mixing tube length 20 mm, Run 13 144
Table B-XII " " " 30 mm, Run 13 145
Table B-XIII " " " 37 mm, Run 13 146
Table B-XIV " " " 37 mm, Run 11 147
Table B-XV " " " 37 mm, Run 12 148
Table B-XVI " " " 37 mm, Run 12 149
Table B-XVII " " " 37 mm, Run 14 150
Table B-XVIII " " " 37 mm, Run 14 151
Table B-XIX " " " 37 mm, Run 10 152

[illegible]

[illegible] RUN NO. 7

Reverse Flow Input Gas
Flow 63 l/min.

Oxygen Content 21 Vol.%

Burn-Back Time Min.	Burner Temperatures Tapping 2, °C	Burner Temperatures Tapping 1, °C	Exit Gas Analysis, Vol.% CO	CO_2	O_2	Equivalent O_2
0	366	230	-	-	-	-
1	363	285	-	-	16.0	-
2	363	280	-	-	13.5	-
3	365	280	1.8	3.7	-	-
4	378	225	3.0	6.7	14.0	20
5	400	253	-	-	12.5	-
6	410	210	2.7	6.7	9.0	17
7	430	285	1.2	13.5	5.4	20
8	440	213	2.1	11.2	6.7	21
9	454	225	2.6	8.6	8.4	18
10	453	280	2.2	6.7	11.0	19
11	445	285	1.9	5.3	14.0	20
12	440	285	1.6	4.7	15.4	21
14	421	283	1.3	3.7	16.4	21
16	403	281	1.2	3.1	17.0	21
18	386	280	1.1	2.7	17.4	21
20	375	215	1.0	2.2	18.0	21
22	365	213	0.9	1.9	-	-
24	355	210	0.8	1.6	19.0	21

TABLE B-II

BURNER BEHAVIOR DURING RUN NO. 5

Reverse Flow Input Gas
Flow 46 l/min.

Oxygen Content: 21 Vol.%

Burn-Back Time Min.	Burner Temperatures		Exit Gas Analysis, Vol.%			
	Tapping B, °C	Tapping A, °C	CO	CO_2	O_2	Equivalent O_2
0	475	270	-	-	-	-
1	485	280	-	-	-	-
2	480	280	0.9	13.2	2.4	16
3	480	280	0.9	15.7	-	-
4	470	280	0.9	15.7	1.8	18
5	440	260	0.9	14.4	2.0	17
6	450	260	1.4	13.2	2.6	17
7	465	265	1.3	12.9	3.0	17
8	460	280	1.2	12.7	3.7	17
9	470	280	1.9	10.7	4.1	16
10	475	287	3.6	7.6	-	-
11	475	265	4.2	5.2	-	-
12	468	280	3.8	4.5	-	-
14	475	275	3.0	3.4	-	-
16	460	250	2.0	2.5	-	-
18	465	265	-	-	-	-
20	470	265	1.1	1.2	17.8	19
22	462	258	1.0	1.0	18.4	20
24	460	258	0.3	0.9	18.6	20
26	460	250	0.9	0.7	18.9	20

TABLE [illegible]

BURNER BURNBACK DURING RUN NO. 6

Reverse Flow Input Gas
Flow 116 l/min.

Oxygen Content 45 Vol.%

Burn-Back Time Min.	Burner Temperatures			Exit Gas Analysis, Vol.%		
	Tapping B, °C	Tapping A, °C	CO	CO_2	O_2	Equivalent O_2
0	[illegible]	[illegible]				
1	[illegible]	[illegible]				
2	[illegible]	[illegible]				
3	[illegible]	[illegible]				
4	[illegible]	[illegible]				
5	[illegible]	[illegible]				
6	[illegible]	[illegible]				
7	[illegible]	[illegible]				
8	[illegible]	[illegible]				
9	[illegible]	[illegible]				
10	[illegible]	[illegible]				
12	[illegible]	[illegible]				
14	[illegible]	[illegible]				
16	[illegible]	[illegible]				
18	[illegible]	[illegible]				
20	[illegible]	[illegible]				
22	[illegible]	[illegible]				
24	[illegible]	[illegible]				
26	[illegible]	[illegible]				
28	[illegible]	[illegible]				

TABLE [illegible]

[illegible] RUN NO. 7

Reverse Flow Input Gas
Flow 113 l/min.

Oxygen Content: 70 Vol.%

Burn-Back Time Min.	Reactor Temperatures		Exit Gas Analysis, Vol.%			
	Topping B, °C	Topping A, °C	CO	CO_2	O_2	Equivalent O_2
0	[illegible]	175	3.8	9.2	[illegible]	70
1	[illegible]	[illegible]	10	13.2	[illegible]	[illegible]
2	[illegible]	[illegible]	2.0	23.0	[illegible]	[illegible]
3	[illegible]	[illegible]	1.5	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	1.0	44.5	[illegible]	70
5	[illegible]	[illegible]	.	.	.	.
6	[illegible]	[illegible]	.	.	.	.
7	[illegible]	[illegible]	.	.	.	.
8	[illegible]	[illegible]	0.8	3.4	[illegible]	[illegible]
9	[illegible]	[illegible]	0.8	2.8	[illegible]	[illegible]
10	[illegible]	[illegible]	0.8	1.6	[illegible]	[illegible]
11	[illegible]	[illegible]	0.7	1.2	[illegible]	[illegible]
12	[illegible]	[illegible]	0.7	1.1	[illegible]	[illegible]

TABLE 3-[illegible]

[illegible] [illegible] DURING RUN NO. [illegible]

Reverse Flow Input Gas
Flow 52 l/min.

Oxygen Content 35 Vol.%

Burn-Back Time Min.	Burner Temperatures		Burn Gas Analysis, Vol.%			
	Topping B, °C	Topping A, °C	CO	CO_2	O_2	Equivalent O_2
0	465	[illegible]	-	-	-	-
1	500	[illegible]	-	-	-	-
2	[illegible]	[illegible]	1.3	17.0	[illegible]	[illegible]
3	[illegible]	[illegible]	1.4	24.3	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	20.5	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	10.7	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	5.0	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	3.6	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	3.1	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	2.7	[illegible]	[illegible]
10	470	[illegible]	[illegible]	2.2	[illegible]	[illegible]

TABLE 3-17

BURNER BURN-BACK DATA, RUN NO. 9

Reverse Flow Input Gas
Flow 150 l/min.

Oxygen Content 62 Vol.%

Burn-Back Time Min.	Burner Temperatures			Exit Gas Analysis, Vol.%		
	Tapping B, °C	Tapping A, °C	[illegible]	CO_2	O_2	Equivalent O_2
0	480	296	-	-	-	-
1	480	296	-	-	-	-
2	500	310	2.0	16.3	46	63
3	605	400	0.9	16.3	54	71
4	600	450	1.1	6.6	58	67
5	650	440	0.9	3.7	59	63
6	650	400	0.5	3.1	59	63
7	615	425	0.9	3.2	59	62
8	590	385	0.9	2.5	59	62
9	570	370	0.8	2.4	-	-
10	550	365	0.8	1.9	60	62
12	530	370	0.8	1.8	60	62
14	510	350	0.7	1.2	60	61
16	495	285	0.7	1.2	60	61

TABLE 3-III ; [illegible]

RUN NO.	1	2	3a	3b	4	5
Bed Temperature, °C	[illegible] ± 16	[illegible] ± 8	[illegible] ± 35	[illegible] ± 11	[illegible] ± 20	[illegible] ± 11
Superficial Gas Velocity, m/s	1.7 ± 0.1	1.6 ± 0.1	1.8 ± 0.2	1.3 ± 0.1	1.8 ± 0.1	1.4 ± 0.2
Air/Fuel [illegible] Ratio, %	23 ± 7	19 ± 2	38 ± 3	26 ± 2	24 ± 2	18 ± 2
Pressure Difference Across Bed, Kilopascals	2.55 ± 0.25	2.55 ± 0.025	2.55 ± 0.05	2.55 ± [illegible]	2.55 ± 0.025	2.55 ± 0.025

TABLE 3-VIII : [illegible]

RUN NO.	6a	6b	7	8	9
Bed Temperature, °C	954 ± 18	901 ± 32	862 ± 58	980 ± 50	887 ± 22
Superficial Gas Velocity, m/s	2.0 ± 0.2	1.8 ± 0.1	1.1 ± 0.3	1.6 ± 0.3	1.4 ± 0.3
Air/Fuel Stoichiometric Ratio, %	41 ± 3	24 ± 2	25 ± 6	29 ± 8	21 ± 4
Pressure Difference Across Bed, Kilopascals	2.48 ± 0.05	2.46 ± 0.005	2.48 ± 0.05	2.46 ± 0.005	2.51 ± 0.005

[illegible]

RUN NO.	10	11	12	13	14
Bed Temperature, °C	925 ± 8	800 ± 3	884 ± 8	814 ± 25	904 ± 15
Superficial Gas Velocity, m/s	3.2 ± 4	0.90 ± 0.05	1.8 ± 0.1	1.27 ± 0.05	1.8 ± 0.1
Air/Fuel Stoichiometric Ratio, %	28 ± 5	20 ± 2	22 ± 2	19 ± 2	25 ± 2
Pressure Difference Across Bed, Kilopascals	2.35 ± 0.1	2.58 ± 0.05	2.53 ± 0.2	1.85 ± 0.2	1.71 ± 0.15
Total Air to Bed, l/min.	1,280 ± 150	393 ± 14	695 ± 19	538 ± 15	946 ± 15

Burn-Back Burner Combustion Tests

The combustion test data is presented in Tables B-1 to B-[illegible]. The method of calculation of the various terms used is presented below.

The gasifier product gas flow was calculated from a nitrogen balance.

$$\text{Gasifier gas flow rate} = \frac{79 \times A + 100 \times N_2 \text{ to purges}}{\% N_2 \text{ in gasifier gas}}$$

where A = total air rate supplied to gasifier bed

The proportion of gasifier product gas passing through the burn-back burner was calculated from a total system air and fuel balance.

$$\begin{array}{l}\text{Total air for complete}\\ \text{combustion at burner}\\ \text{and flare, C}\end{array} = \frac{100 - S}{S} \times A$$

where S = Air/fuel substoichiometric ratio % in gasifier bed

$$\begin{array}{l}\text{Proportion of gasifier}\\ \text{gas passing through}\\ \text{burn-back burner}\end{array} = \frac{B}{C}$$

The term B refers to the air required for stoichiometric complete combustion in the burn-back burner, and was taken as the mean of the values calculated from the burner flue gas analyses.

$$B = \begin{array}{l}\text{Primary + secondary air}\\ \text{supplied to burner}\end{array} \times \frac{(1 - O_2 - 0.5\ CO)}{21}$$

where CO, O_2 = vol.% carbon monoxide, oxygen in flue gas respectively.

The primary air velocity

$$= \frac{\text{Flow rate at ambient temperature}}{\text{Area of primary air duct}}$$

The secondary air velocity was derived similarly.

The burner throat loading

$$= \frac{\text{(Flow rate of gasifier product gas through burn-back burner corrected for temperature)}}{\text{(Area of annulus between end of outer surface of primary air duct and refractory lining)}}$$

'Mixing' Tube Length, Distance X in Figure B.1 cm	Burner Throat Area cm²
37	19.9
30	16.8
20	11.8

Model for Prediction of Flue Gas Analyses -

Input -	Gasifier gas	100 moles
	Air	X moles
Output -	Dry flue gas	Y moles
	Water	Z moles

Gasifier Product Gas -

	% Vol.	C	O	H
CO_2	7.3	7.3	14.6	
CO	7.8	7.8	7.8	
H_2	8.0			16.0
CH_4	7.3	7.3		29.2
C_2H_4	2.6	5.2		10.4
C_2H_6	0.05	0.1		0.3
N_2	66.9			
		27.7	22.4	55.9

Flue gas -

	% Vol.	C	O
CO_2	CO_2	CO_2	$2CO_2$
O_2	O_2		$2O_2$
N_2	N_2		
		CO_2	$2(CO_2 + O_2)$

Balances -

C $\quad 27.7 = \frac{CO_2}{100} \times Y$

O $\quad 0.42X + 22.4 = Z + \frac{2(CO_2 + O_2)}{100} \times Y$

H $\quad 55.9 = 2Z$

N_2 $\quad 66.9 + 0.79\,X = \frac{(100 - (CO_2 + O_2))}{100} \times Y$

(a) For stoichiometric air: O_2 vol.% in flue gas = 0

X = 145.12, CO_2 % vol. = 12.90 from balance equations

(b) For > stoichiometric air supply:

% Stoichiometric Air Supplied	X Moles Air Supplied	CO_2 % Vol. In Flue Gas	O_2 % Vol. In Flue Gas
120	174.14	11.36	2.50
140	203.17	10.15	4.47
180	261.22	8.37	7.37
220	319.26	7.12	9.40
260	377.31	6.20	10.91
340	493.41	4.92	12.99
420	609.50	4.08	14.36

$$CO_2\ \% = \frac{2{,}770}{69.66 + X} \qquad \text{from balance equations}$$

$$O_2\ \% = \frac{42X - 6096}{2(69.66 + X)}$$

Flue gas for < stoichiometric air supply -

	% Vol.	C	O
CO_2	CO_2	CO_2	$2CO_2$
CO	CO	CO	CO
N_2	N_2	$\overline{CO_2 + CO}$	$\overline{2CO_2 + CO}$

Balances -

$$C \quad 87.7 = \frac{(CO_2 + CO)}{100} \times Y$$

$$O \qquad 0.42X + 28.4 = Z + \frac{(2CO_2 + CO)}{100} \times Y$$

$$H \qquad 55.9 = 2Z$$

$$N_2 \qquad 66.9 + 0.79X = \frac{(100 - (CO_2 + CO))}{100} \times Y$$

CO_2 % = $\frac{[illegible]}{0.79X + 94.8}$

CO % = $\frac{[illegible]}{0.79X + 94.8}$ from balance equations

% Stoichiometric Air Supplied	X Moles Air Supplied	CO_2 % Vol. In Flue Gas	CO % Vol. In Flue Gas
100	145.12	13.84	0
90	130.61	10.98	3.08
80	116.10	8.33	6.54
60	87.07	0.03	14.98

TABLE 3-1 : [illegible]

Run No.	Stoichiometric Air Requirement l/min.	Burner Throat Loading m/s	% Total Oxidizer Gas Through Burner Throat	Gas Temperature Thermocouple °C A	 B	Mixing Tube Length, X In Figure 2, p.28 cm
10	2,540 ± 300	21 ± 6	72 ± 19	485 ± 50	645 ± 11	37 ± 2
14	1,750 ± 270	12 ± 2	97 ± 16	290 ± 15	450 ± 50	37 ± 2
12	2,240 ± 260	12 ± 1	87 ± 13	336 ± 13	503 ± 36	37 ± 2
11	750 ± 150	3.0 ± 0.4	49 ± 10	197 ± 3	308 ± 9	37 ± 2
13a	750 ± 70	2.7 ± 0.4	33 ± 14	180 ± 10	265 ± 6	37 ± 2
13b	750 ± 70	3.0 ± 0.3	31 ± 3	173 ± 3	252 ± 3	30 ± 2
13c	465 ± 50	3.1 ± 0.7	21 ± 5	180 ± 8	250 ± 10	22 ± 2

[illegible]

[illegible], [illegible]

RUN NO. 13

Primary Air Velocity Thru' Input Duct Metres/Sec	Secondary Air Velocity Thru' Several Holes Metres/Sec/Hole *	Primary Aeration % Stoich	Total Aeration % Stoich	Dry Flue Gas Analysis Vol.% CO	CO_2	O_2
3.4 ± 0.3	10 ± 1	37 ± 3	147	0	11.2	4.0
3.4 ± 0.3	8 ± 1	37 ± 3	125	0	11.4	3.5
3.4 ± 0.3	4 ± 1	37 ± 3	81	0	12.2	0
3.4 ± 0.3	0	37 ± 3	57		[illegible]	
4.6 ± 0.3	0	52 ± 4	50		[illegible]	
4.6 ± 0.3	4 ± 1	50 ± 4	94		[illegible]	
4.6 ± 0.3	5 ± 1	50 ± 4	105		[illegible]	
4.6 ± 0.3	10 ± 1	50 ± 4	160		[illegible]	
1.7 ± 0.3	10 ± 1	19 ± 1	189	-	-	-
1.7 ± 0.3	4 ± 1	19 ± 1	63	-	-	-
3.5 ± 0.3	10 ± 1	35 ± 3	149	0	11.2	5.5
3.5 ± 0.3	5 ± 1	35 ± 3	94	0	12.2	0
3.5 ± 0.3	20 ± 1	35 ± 3	153	0	6.2	12.5
3.5 ± 0.3	45 ± 1	35 ± 3	[illegible]	0	3.0	14.6
3.5 ± 0.3	36 ± 1	35 ± 3	[illegible]	0	3.6	15.0
0	28 ± 1	0	[illegible]	0	5.3	12.7
0	45 ± 1	0	[illegible]	0	1.8	14.5

* 72 holes – see page 2[illegible].

TABLE 3-XII

[illegible]

RUN NO. 13

Primary Air Velocity Thru 2" Input Duct Meters/Sec	Secondary Air Velocity Thru 2" Throat Holes Meters/Sec/Hole*	Primary Aeration % Stoich.	Total Aeration % Stoich.	Dry Flue Gas Analysis Vol.%		
				CO	CO$_2$	O$_2$
4.3 ± 0.3	4 ± 1	28 ± 1	55	—	[illegible]	—
4.4 ± 0.3	4 ± 1	29 ± 1	56	—	[illegible]	—
3.8 ± 0.3	4 ± 1	23 ± 1	49	—	[illegible]	—
3.5 ± 0.3	15 ± 1	25 ± 1	125	0	13.8	2.0
3.5 ± 0.3	4 ± 1	25 ± 1	50	7.8	7.4	0

* 32 holes – see page 24.

[illegible]

[illegible]

[illegible]

Primary Air Velocity Thro' Input Duct Metres/Sec	Secondary Air Velocity Thro' Throat Holes Metres/Sec/Hole*	Primary Aeration % Stoich	Total Aeration % Stoich	Dry Flue Gas Analysis Vol.% CO	CO$_2$	O$_2$
3.4 ± 0.3	16 ± 1	25 ± 2	136	0	11.7	3.3
3.4 ± 0.3	15 ± 1	25 ± 2	125	0	11.9	2.7
3.4 ± 0.3	13 ± 1	25 ± 2	165	0	12.5	1.9
3.4 ± 0.3	11 ± 1	25 ± 2	96	0.3	13.5	0
3.4 ± 0.3	13 ± 1	25 ± 2	140	0	12.1	2.5
3.4 ± 0.3	15 ± 1	25 ± 2	125	0	12.5	5.0
3.4 ± 0.3	11 ± 1	25 ± 2	96	0	12.1	0
3.4 ± 0.3	19 ± 1	25 ± 2	156	0	8.4	8.5
3.4 ± 0.3	24 ± 1	25 ± 2	150	0	6.9	11.0
3.4 ± 0.3	28 ± 1	25 ± 2	184	0	5.8	12.0
3.4 ± 0.3	45 ± 1	25 ± 2	282	0	4.8	13.5
3.4 ± 0.3	9 ± 1	25 ± 2	85	0	11.7	0
3.4 ± 0.3	7 ± 1	25 ± 2	68	0	12.2	0
3.4 ± 0.3	4 ± 1	25 ± 2	49	2.2	11.7	0
2.5 ± 0.3	19 ± 1	17 ± 1	151	0	11.7	4.5
2.5 ± 0.3	16 ± 1	17 ± 1	130	0	12.4	3.6
2.8 ± 0.3	4 ± 1	19 ± 1	46	-	10.7	0
4.3 ± 0.3	9 ± 1	28 ± 2	68	-	11.2	0
4.3 ± 0.3	7 ± 1	28 ± 2	75	-	9.0	0
4.3 ± 0.3	45 ± 1	28 ± 2	274	0	3.2	13.2

* 12 holes - see page 24.

TABLE 3-XIV

MIXING TESTS [illegible]

RUN NO. 11

Primary Air Velocity Thru' Input Duct Meters/Sec	Secondary Air Velocity Thru' Shroud Holes Meters/Sec/Hole*	Primary Aeration % Stoich	Total Aeration % Stoich	Dry Flue Gas Analysis Vol.% CO	CO₂	O₂
0	45 ± 1	0	306 ± 30	0	6.0	12.3
0	4 ± 1	0	27 ± 3	9.0	7.8	0
0	19 ± 1	0	135 ± 13	0	11.4	4.2
15.3 ± 0.3	19 ± 1	101 ± 10	235 ± 22	—	OFF	—
7.3 ± 0.3	19 ± 1	46 ± 4	182 ± 17	0	9.4	7.5
7.3 ± 0.3	45 ± 1	46 ± 4	350 ± 35	0	3.0	13.5
7.3 ± 0.3	4 ± 1	46 ± 4	75 ± 7	6.4	12.8	0
7.3 ± 0.3	6 ± 1	46 ± 4	88 ± 8	0	13.4	0
7.3 ± 0.3	8 ± 1	46 ± 4	102 ± 10	0	13.7	0
7.3 ± 0.3	6 ± 1	46 ± 4	88 ± 8	0	13.2	0
7.3 ± 0.3	0	46 ± 4	46 ± 4	—	OFF	—
2.8 ± 0.3	19 ± 1	19 ± 2	152 ± 15	0	10.3	7.5
2.8 ± 0.3	45 ± 1	19 ± 2	325 ± 31	0	4.5	12.5
2.8 ± 0.3	4 ± 1	19 ± 2	46 ± 4	6.0	6.0	0
2.8 ± 0.3	0	19 ± 2	19 ± 2	—	OFF	—
11.1 ± 0.3	10 ± 1	74 ± 6	146 ± 13	0	11.1	5.0
11.1 ± 0.3	6 ± 1	74 ± 6	114 ± 11	0	-	-
11.1 ± 0.3	4 ± 1	74 ± 6	100 ± 10	0	13.5	0
11.1 ± 0.3	0	74 ± 6	74 ± 6	—	OFF	—
11.1 ± 0.3	5 ± 1	74 ± 6	107 ± 10	0	14.1	0.2
14.0 ± 0.3	5 ± 1	93 ± 8	126 ± 12	0	11.7	4.3
14.0 ± 0.3	4 ± 1	93 ± 8	119 ± 11	0	12.7	3.0
14.0 ± 0.3	10 ± 1	93 ± 8	159 ± 15	0	9.0	8.5
14.0 ± 0.3	10 ± 1	93 ± 8	163 ± 16	—	OFF	—

* 32 holes - see page 28.

[illegible]

[illegible]

RUN NO. 12

Primary Air Velocity Thru* Input Duct Meters/Sec	Secondary Air Velocity Thru* Throat Holes Meters/Sec/Hole*	Primary Aeration % Stoich	Total Aeration % Stoich	Dry Flue Gas Analysis Vol.% CO	CO$_2$	O$_2$
15.4 ± 0.3	27 ± 1	36 ± 3	100 ± 10	0	13.5	0
15.4 ± 0.3	36 ± 1	36 ± 3	119 ± 12	0	13.5	1.3
15.3 ± 0.3	45 ± 1	36 ± 3	129 ± 13	0	11.7	4.3
15.4 ± 0.3	20 ± 1	36 ± 3	69 ± 7	4.5	11.2	0
15.5 ± 0.3	15 ± 1	36 ± 3	61 ± 6	6.3	10.8	0
15.5 ± 0.3	4 ± 1	36 ± 3	45 ± 5	8.4	7.8	0
11.8 ± 0.3	29 ± 1	27 ± 2	86 ± 9	1.7	13.5	0.4
11.8 ± 0.3	45 ± 1	27 ± 2	125 ± 12	0	12.4	3.0
11.8 ± 0.3	36 ± 1	27 ± 2	110 ± 11	[illegible]	13.8	0.6
11.8 ± 0.3	20 ± 1	27 ± 2	75 ± 7	4.8	10.7	0
11.8 ± 0.3	15 ± 1	27 ± 2	60 ± 5	6.3	10.8	0
11.8 ± 0.3	5 ± 1	27 ± 2	35 ± 3	7.2	8.6	0
8.7 ± 0.3	5 ± 1	20 ± 2	28 ± 2	7.8	7.6	0
8.7 ± 0.3	10 ± 1	20 ± 2	44 ± 4	6.7	8.8	0
8.7 ± 0.3	15 ± 1	20 ± 2	55 ± 5	7.2	8.4	0
8.7 ± 0.3	20 ± 1	20 ± 2	66 ± 6	6.5	8.4	0
8.7 ± 0.3	29 ± 1	21 ± 2	83 ± 8	4.2	10.8	0
8.7 ± 0.3	36 ± 1	20 ± 2	105 ± 10	0	10.9	2.1
8.7 ± 0.3	40 ± 1	20 ± 2	125 ± 13	0	11.9	2.2
8.7 ± 0.3	45 ± 1	20 ± 2	127 ± 12	0	12.4	2.1
5.8 ± 0.3	5 ± 1	13 ± 1	25 ± 2	5.6	9.4	0
5.8 ± 0.3	10 ± 1	13 ± 1	37 ± 3	6.9	9.8	0
5.8 ± 0.3	15 ± 1	13 ± 1	42 ± 3	7.8	9.6	0
5.8 ± 0.3	20 ± 1	13 ± 1	44 ± 5	5.4	9.2	0
5.8 ± 0.3	29 ± 1	13 ± 1	66 ± 7	4.9	10.1	0

* 12 inches - see page 24.

TABLE [illegible]

[illegible]

[illegible] NO. 12

Primary Air Velocity Thru' Input Duct Metres/Sec	Secondary Air Velocity Thru' Throat Holes Metres/Sec/Hole*	Primary Aeration % Stoich	Total Aeration % Stoich	Dry Flue Gas Analysis Vol.%		
				CO	CO_2	O_2
5.8 ± 0.3	39 ± 1	13 ± 1	96 ± 8	2.5	10.0	0
5.8 ± 0.3	40 ± 1	13 ± 1	108 ± 10	0	10.7	4.2
5.8 ± 0.3	45 ± 1	12 ± 1	120 ± 12	0	11.2	4.9
2.8 ± 0.3	5 ± 1	7 ± 1	18 ± 1	8.8	6.3	0
2.8 ± 0.3	10 ± 1	7 ± 1	30 ± 2	4.3	6.3	0

* 22 holes - see page 24.

[illegible]

[illegible]

[illegible]

Primary Air Velocity Thru' Input Duct Metres/Sec	Secondary Air Velocity Thru' Second Holes Metres/Sec/Hole*	Primary Aeration % Stoich.	Total Aeration % Stoich.	Dry Flue Gas Analysis Vol.% CO	CO$_2$	O$_2$
15.5 ± 0.3	20 ± 1	45 ± 3	100	0	13.4	0
15.5 ± 0.3	24 ± 1	45 ± 3	114	0	13.2	1.9
15.5 ± 0.3	26 ± 1	45 ± 3	108	0	13.2	0
15.5 ± 0.3	29 ± 1	45 ± 3	128	0	11.2	5.0
15.4 ± 0.3	38 ± 1	45 ± 3	145	0	10.7	5.5
15.4 ± 0.3	45 ± 1	45 ± 3	178	0	9.2	7.8
15.5 ± 0.3	20 ± 1	45 ± 3	110	0	12.9	0
15.5 ± 0.3	24 ± 1	45 ± 3	[illegible]	0	12.9	2.0
15.5 ± 0.3	29 ± 1	45 ± 3	128	0	12.9	3.0
15.4 ± 0.3	45 ± 1	45 ± 3	178	0	10.8	6.5
15.5 ± 0.3	35 ± 1	45 ± 3	96	5.0	16.5	0
15.5 ± 0.3	20 ± 1	45 ± 3	100	0	12.7	0
15.5 ± 0.3	10 ± 1	45 ± 3	71	7.0	9.2	0
15.5 ± 0.3	8 ± 1	45 ± 3	66	8.6	8.4	0
15.5 ± 0.3	4 ± 1	45 ± 3	55	8.7	7.6	0
15.5 ± 0.3	0	45 ± 3	45	9.0	7.6	0
5.8 ± 0.3	47 ± 1	16 ± 1	61	5.6	9.6	0
5.8 ± 0.3	29 ± 1	16 ± 1	101	0	12.7	0
5.8 ± 0.3	38 ± 1	16 ± 1	116	0	13.2	1.5
5.8 ± 0.3	40 ± 1	16 ± 1	138	0	12.2	2.9
5.8 ± 0.3	45 ± 1	16 ± 1	145	0	10.7	5.0
5.8 ± 0.3	[illegible]	16 ± 1	-	0	10.0	5.8
5.8 ± 0.3	38 ± 1	16 ± 1	116	0	12.7	5.6
5.8 ± 0.3	37 ± 1	16 ± 1	121	0	12.9	1.5
5.8 ± 0.3	40 ± 1	16 ± 1	130	0	12.9	2.0

* 32 holes - see page 24.

[illegible]

[illegible]

[illegible]

Primary Air Velocity Thru' Tuyere Duct Metres/Sec	Secondary Air Velocity Thru' Throat Holes Metres/Sec/Hole *	Primary Aeration % Stoich.	Total Aeration % Stoich.	Dry Flue Gas Analysis Vol. %		
				CO	CO_2	O_2
5.8 ± 0.3	36 ± 1	16 ± 1	119	0	12.9	1.5
5.8 ± 0.3	15 ± 1	16 ± 1	58	7.1	8.6	0
5.8 ± 0.3	10 ± 1	16 ± 1	44	7.9	8.2	0
5.8 ± 0.3	4 ± 1	16 ± 1	27	8.9	8.4	0
5.8 ± 0.3	0	16 ± 1	16	8.5	8.8	0
0	45 ± 1	0	131	0	12.2	2.3
0	35 ± 1	0	85	4.1	10.3	0
0	28 ± 1	6	56	6.3	8.8	0

* 12 holes - see page 28.

TABLE 2-[illegible]

MIXING TUBE LENGTH, cm [illegible]

RUN NO. 10

Primary Air Velocity Thro' Input Duct Metres/Sec	Secondary Air Velocity Thro' Shroud Holes Metres/Sec/Hole*	Primary Aeration % Stoich	Total Aeration % Stoich	Dry Flue Gas Analysis Vol.% CO	CO$_2$	O$_2$
13.9 ± 0.3	40 ± 1	29 ± 2	96 ± 9	6.0	10.3	1.2
13.9 ± 0.3	45 ± 1	26 ± 2	105 ± 10	4.0	11.4	1.2
13.9 ± 0.3	25 ± 1	24 ± 2	75 ± 7	8.0	9.2	1.7
13.9 ± 0.3	20 ± 1	20 ± 2	65 ± 6	8.8	8.4	1.1
13.9 ± 0.3	10 ± 1	20 ± 2	45 ± 4	7.0	8.[illegible]	1.5
5.8 ± 0.3	45 ± 1	10 ± 1	81 ± 8	5.6	10.7	1.0
5.8 ± 0.3	10 ± 1	10 ± 1	26 ± 2	7.2	9.0	0.6
5.8 ± 0.3	25 ± 1	10 ± 1	54 ± 5	7.5	8.4	1.9
0	45 ± 1	0	81 ± 7	6.3	10.0	1.5
0	20 ± 1	0	35 ± 3	8.8	8.8	0.8
13.2 ± 0.3	50 ± 1	27 ± 2	90 ± 8	1.7	12.9	1.0

* 12 holes – see page 26.

APPENDIX C

Spent Lime Weathering Results

Page

Figure C-1 Apparatus 154

Effect of Weathering on Deadburned Spent Lime 155

Table C-I Sample Treatment Temperatures 155

Determination of the Chemical Composition of Spent Lime 155

Sintered and Weathered Material Composition Tables C-II to C-XIII 160

Sintered and Weathered Material Analyses Tables C-XIV to C-XIX 172

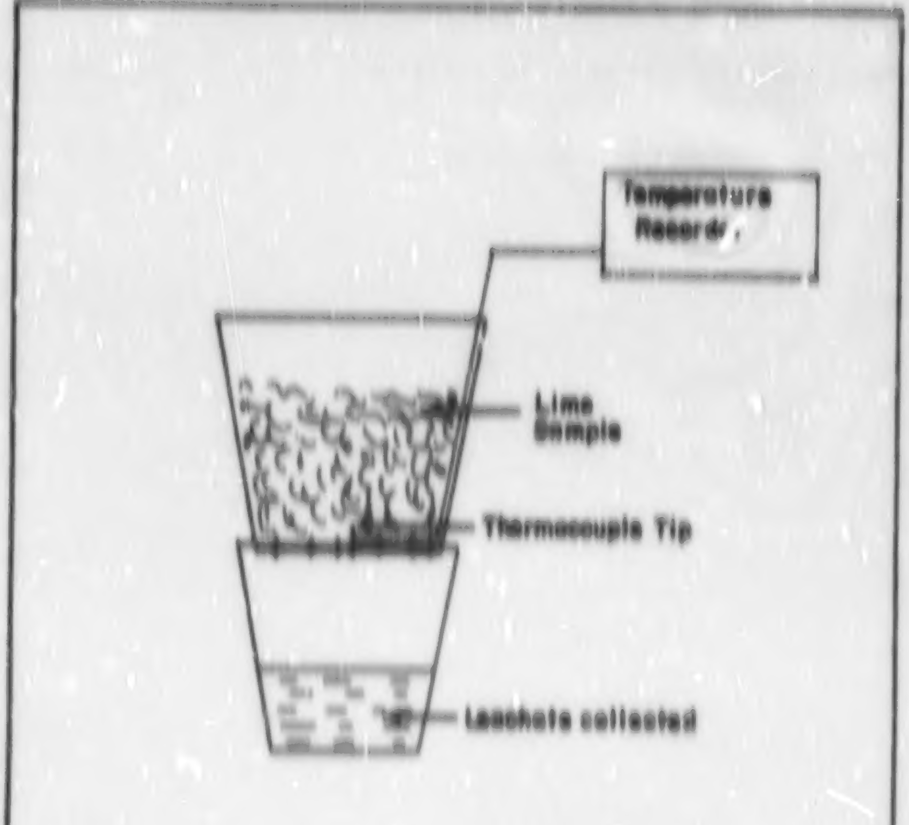
Analyses of Sintered Lime Leachates Tables C-XX to C-XXV 178

Apparatus

Six rigid P.V.C. containers with six collection vessels were set up as shown in Figure C.1. The containers were left outside and rainwater allowed to leach through the sintered spent lime in the upper vessel and into the lower one. A thermocouple was placed in each upper container so as to penetrate the lime sample to one inch from the bottom of the container. The thermocouples were connected to a temperature recorder fitted with a timer and the spent lime temperature was monitored for the first month of weathering. Subsequently, the temperature was recorded for one hour each day at noon.

Fig C.1.

Apparatus for Weathering Sintered Lime



Effect of Weathering on the Deadburned Spent Lime

Material used in the process was spent lime discarded from the CAFB pilot plant during Run 8. The test programme consisted of two parts, namely deadburning and weathering tests.

Six samples weighing 2.2 kilograms each were deadburned in a graphite crucible in an inert atmosphere to a specified temperature, as shown in Table C.I.

Table C.I. : Sample Treatment Temperatures

Sample No.	Deadburning Temperature, °C	Time hours
1	1350	1
2	1350	3
3	1450	1
4	1450	3
5	1550	1
6	1550	3

The deadburned samples were placed in the perforated containers and allowed to weather for twelve months. A sample of the material from each container was analysed before weathering. Thereafter a sample of the material was taken at fortnightly intervals for the first month and then at monthly intervals. Before sampling the material was thoroughly mixed except for the months of December and January when a sample was taken from the top of the bed of weathering material. The samples were dried at 110°C to constant weight and analysed for:

CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3, Na_2O, S, V, CO_2

released, and loss in weight at 600°C under N_2.

A sample of the rainwater leached through the sintered lime and collected in the lower container was taken at the same intervals and analysed for:

Ca, Mg, Si, Fe, Al, Na, and V

The results of these analyses are given in Tables C.XX to C.XXV.

The temperature of the spent lime in the upper container was recorded continuously for the first month and thereafter for one hour each day at noon. The results are shown in Figure 25 in the Discussion section.

Determination of the Chemical Composition of the Spent Lime

The chemical composition of the weathered sintered spent lime is shown in Tables C.I to C.XIII based on the analytical results given in

Tables C.XIV to C.XIX. The calculations made involve several assumptions. Examples of these calculations, errors and assumptions are presented below. Only the total sulphur % weight was measured. The calculation of the calcium sulphide % weight and the calcium sulphate % weight involved the assumption that after 10 to 12 months weathering the sintered spent lime contained no calcium sulphide. This assumption allowed derivation of a % wt. $CaSO_4$/CaO equivalent ratio which was assumed constant.

Analysis	Assumed Maximum Error
CaO equivalent	± 3%
CO_2	± 3%
Total S	± 0.2%
Metal oxides	± 10%
% $CaSO_4$/CaO equivalent	± 10%

Examples

1. 3 hours sintering at 1350°C sampled December

CaO equivalent = 54.6 ± 1.6%

CO_2 released = 29.7 ± 0.9%

Total S = 3.14 ± 0.2%

% $CaSO_4$/CaO equivalent = 0.112 ± .011

% wt. $CaSO_4$ = (54.6 ± 1.6) x (.112 ± .011) = 6.1 ± 0.6

% wt. S as SO_4 = $(6.1 \pm .6) \times \frac{32}{136}$ = 1.4 ± .1

% S in CaS = (3.14 ± 0.2) − (1.4 ± .1) = 1.7 ± 0.2

% wt. CaS = $(1.7 \pm 0.2) \times \frac{72}{32}$ = 3.8 ± 0.6

% wt. $CaCO_3$ = % wt. CO_2 released x $\frac{100}{44}$

= $(29.7 \pm .9) \times \frac{100}{44}$ = 67.5 ± 2.0

Nett CaO equivalent $= \%$ wt. $CaSO_4 \times \frac{56}{136}$

$+ \%$ wt. $CaCO_3 \times \frac{56}{100} + \%$ wt. $CaS \times \frac{56}{72}$

$= (54.6 \pm 1.6) - (43.3 \pm 1.2)$

$= 11.3 \pm 2.1$

% wt. Metal Oxides $= \%$ wt. $MgO + \%$ wt. $SiO_2 + \%$ wt. Fe_2O_3

$+ \%$ wt. $V_2O_5 + \%$ wt. $Al_2O_3 + \%$ wt. Na_2O

$= 2.2 \pm 0.2$

Balance so far:

	% wt.
CaO	11.3 ± 2.1
$CaCO_3$	67.5 ± 2.0
$CaSO_4$	6.1 ± 0.6
CaS	3.8 ± 0.6
Metal oxides	2.2 ± 0.2
Balance	9.1 ± 3.0

11.3 % wt. CaO requires $11.3 \times \frac{18}{56} = 3.6 \pm .7$ %wt. H_2O

to form $Ca(OH)_2$ completely.

Assume all CaO is combined with H_2O as $Ca(OH)_2$

% wt. SrO = 0   % wt. $Ca(OH)_2 = 14.9 \pm 2.8$

% Chemically uncombined $H_2O = (9.1 \pm 3.0) - (3.6 \pm 0.7)$

$= 5.5 \pm 3.1$

Resulting Composition:	% wt.
CaO	0.0
Ca $(OH)_2$	14.8 ± 2.4
$CaCO_3$	67.5 ± 2.0
$CaSO_4$	6.1 ± 0.6
CaS	3.8 ± 0.6
Metal Oxides	2.2 ± 0.2
Free H_2O	5.5 ± 3.1
Total	99.9 ± 4.5

$$Ca(OH)_2 \text{ \% molar of total calcium} = \frac{\text{gm.moles } Ca(OH)_2 \times 100}{\text{total gm. moles Ca salts}}$$

Total gm. moles Ca in 100 gm. sample

$$= \frac{14.8 \pm 2.4}{74} + \frac{67.5 \pm 2.0}{100} + \frac{6.1 \pm .6}{136} + \frac{3.8 \pm .6}{72}$$

$$= 0.97 \pm 0.08$$

$$Ca\,(OH)_2 \text{ \% molar} = 20.6 \pm 4.0 \%$$

2. 1 hour sintering at 1350°C sampled mid-October

Calculated as before:	% wt.
CaO	60.4
$CaCO_3$	11.9
$CaSO_4$	8.2
CaS	3.3
Metal oxides	3.8
Balance	12.4

60.4 % wt. CaO requires 19.4% wt. H_2O

Assume all balance remaining is H_2O combined with CaO as $Ca(OH)_2$.

$$\% \text{ wt. } CaO = 60.4 - 12.4 \times \frac{56}{18} = 21.7$$

$$\% \text{ wt. } Ca(OH)_2 = 12.4 \times \frac{74}{18} = 51.00$$

Composition:

	% wt.
CaO	21.7
$Ca(OH)_2$	51.0
$CaCO_3$	11.9
$CaSO_4$	8.2
CaS	3.3
Metal oxides	3.8
Free H_2O	0.0
Total	100.1

The observed ignition losses under N_2 at 600°C for the weathered sintered spent lime samples are shown in Tables C.VIII to C.XIII. The predicted ignition losses are based on the assumption that the weight loss was due to the loss of free water and the decomposition of the calcium hydroxide according to the reaction:

$$Ca(OH)_2 \xrightarrow[N_2]{600°C} CaO + H_2O$$

The chemicalanalyses for the sintered lime leachate water are given in Tables C.XX to C.XXV.

TABLE C.II

SINTERING TIME, hr   1

SINTERING TEMP, °C   1350

SINTERED AND WEATHERED MATERIAL COMPOSITION

CALCIUM SALTS MOLAR % OF TOTAL CALCIUM

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS
Sept*	91.2	0.0	0.1	4.6	4.0
Oct ½	29.7	53.0	9.1	4.6	3.5
Oct 1	0.0	82.6	9.7	4.6	3.1
Nov	1.5	81.7	10.0	4.6	2.2
Dec †	0.0	24.7	65.0	4.6	5.6
Jan †	0.0	25.1	66.6	4.6	3.6
Feb	-	-	-	-	-
Mar	0.0	53.1	42.3	4.6	0.0
Apr	0.0	79.7	15.6	4.6	0.0
May	0.0	76.6	19.3	3.7	0.5
June	0.0	51.5	43.4	3.7	1.3
July	0.0	60.5	35.6	3.8	0.0
August	0.0	45.0	51.1	3.9	0.1
Sept	0.0	39.1	57.2	3.7	0.0

* Not exposed to weather   † sampled from top of bed

TABLE C.III

SINTERING TIME, hr 3

SINTERING TEMP, °C 1350

SINTERED AND WEATHERED MATERIAL COMPOSITION

CALCIUM SALTS MOLAR % OF TOTAL CALCIUM

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS
Sept*	90.3	0.0	0.2	4.6	5.0
Oct ½	15.6	73.0	3.6	4.6	3.1
Oct 1	0.0	80.0	12.9	4.6	2.5
Nov	16.6	64.7	13.2	4.6	0.8
Dec †	0.0	20.6	69.4	4.6	5.4
Jan †	0.0	27.0	68.0	4.6	0.4
Feb	-	-	-	-	-
Mar	0.0	57.5	37.9	4.6	0.0
Apr	0.0	73.6	21.8	4.6	0.0
May	0.0	80.0	17.9	1.6	0.0
June	0.0	34.9	63.9	1.5	0.0
July	0.0	67.1	28.0	4.9	0.0
August	0.0	47.2	48.9	3.1	0.7
Sept	0.0	58.5	38.3	3.1	0.0

* Not exposed to weather † sampled from top of bed

TABLE C.IV

SINTERING TIME, hr 1

SINTERING TEMP, °C 1400

SINTERED AND WEATHERED MATERIAL COMPOSITION

CALCIUM SALTS MOLAR % OF TOTAL CALCIUM

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS
Sept*	91.6	0.0	0.1	4.6	3.7
Oct ½	24.1	64.0	5.8	4.6	1.5
Oct 1	0.0	77.8	14.5	4.6	3.0
Nov	0.0	84.1	9.3	4.6	2.0
Dec †	0.0	15.8	73.9	4.6	5.6
Jan †	0.0	17.8	77.3	4.6	0.3
Feb	0.0	84.7	10.7	4.6	0.0
Mar	0.0	61.1	34.3	4.6	0.0
Apr	0.0	70.4	25.0	4.6	0.0
May	0.0	68.8	27.6	3.3	0.2
June	0.0	35.3	62.7	1.4	0.6
July	0.0	69.6	29.0	1.4	0.0
August	0.0	44.1	52.4	3.3	0.2
Sept	0.0	59.5	39.1	1.4	0.0

* Not exposed to weather † Sampled from top of bed

TABLE C.V

SINTERING TIME, hr 3

SINTERING TEMP, °C 1450

SINTERED AND WEATHERED MATERIAL COMPOSITION

CALCIUM SALTS MOLAR % OF TOTAL CALCIUM

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS
Sept*	93.3	0.0	0.1	4.6	2.0
Oct ½	31.4	60.4	2.1	4.6	1.4
Oct 1	0.0	87.4	5.3	4.6	2.7
Nov	0.0	83.6	9.8	4.6	1.9
Dec †	0.0	17.3	72.9	4.6	5.2
Jan †	0.0	26.3	67.9	4.6	1.2
Feb	0.0	82.0	13.3	4.6	0.0
Mar	0.0	47.0	48.4	4.6	0.0
Apr	0.0	81.6	13.8	4.6	0.0
May	0.0	74.0	22.1	3.3	0.5
June	0.0	45.2	52.9	1.4	0.5
July	0.0	57.9	38.8	3.3	0.0
August	0.0	61.7	35.0	3.3	0.0
Sept	0.0	27.9	68.8	3.3	0.0

* Not exposed to weather † Sampled from top of bed

TABLE C.VI

SINTERING TIME, hr 1

SINTERING TEMP, °C 1550

SINTERED AND WEATHERED MATERIAL COMPOSITION

CALCIUM SALTS MOLAR % OF TOTAL CALCIUM

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS
Sept*	93.7	0.0	0.1	4.6	1.6
Oct ½	25.0	64.0	2.9	4.6	3.5
Oct 1	4.5	77.5	11.4	4.6	1.9
Nov	0.0	69.1	24.1	4.6	2.[illegible]
Dec †	0.0	0.0	90.8	4.6	3.6
Jan †	0.0	5.1	90.0	4.6	0.3
Feb	0.0	76.7	18.6	4.6	0.0
Mar	0.0	86.6	8.8	4.6	0.0
Apr	0.0	80.3	15.1	4.6	0.0
May	0.0	76.4	19.2	4.4	0.0
June	0.0	39.8	56.5	3.7	0.0
July	0.0	66.5	29.7	3.8	0.0
August	0.0	49.8	46.7	3.5	0.0
Sept	-	-	-	-	-

* Not exposed to weather † Sampled from top of bed

TABLE C.VII

SINTERING TIME, hr 3

SINTERING TEMP, °C 1550

SINTERED AND WEATHERED MATERIAL COMPOSITION

CALCIUM SALTS MOLAR % OF TOTAL CALCIUM

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS
Sept*	93.7	0.0	0.1	4.6	1.6
Oct ½	19.1	71.4	1.9	4.6	3.0
Oct 1	0.0	80.9	11.6	4.6	2.8
Nov	4.0	63.6	26.3	4.6	1.5
Dec †	0.0	10.6	82.7	4.8	1.9
Jan †	0.0	8.9	86.2	4.6	0.3
Feb	8.7	58.9	27.3	4.6	0.5
Mar	0.0	72.5	22.8	4.6	0.0
Apr	0.0	67.7	27.7	4.6	0.0
May	0.0	64.4	32.1	3.5	0.0
June	0.0	61.9	34.5	3.6	0.0
July	0.0	62.9	33.7	3.4	0.0
August	0.0	54.1	42.3	3.6	0.0
Sept	0.0	53.6	42.0	4.3	0.0

* Not exposed to weather † Sampled from top of bed

TABLE C.VIII

SINTERING TIME, hr 1

SINTERING TEMP, °C 1350

SINTERED AND WEATHERED MATERIAL COMPOSITION

% WEIGHT BASIS

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS	Metal Oxides	Free H_2O	Loss at 600°C under Nitrogen	
								Predicted	Observed
Sept*	80.7	0.0	0.2	10.9	5.0	4.1	0.0	0.0	0.3
Oct ½	21.7	51.2	11.9	8.2	3.3	3.8	0.0	12.5	9.2
Oct 1	0.0	73.1	11.6	7.5	2.7	3.3	1.9	19.6	15.2
Nov	1.0	74.0	12.3	7.7	1.9	3.2	0.3	18.0	15.2
Dec †	0.0	18.0	63.9	6.1	4.0	1.9	0.0	10.4	22.9
Jan †	0.0	18.5	66.3	6.2	2.6	2.2	4.2	8.7	22.9
Feb	16.3	57.1	15.8	8.0	0.5	2.8	0.0	13.9	17.8
Mar	0.0	42.7	45.9	6.8	0.0	3.9	0.7	11.1	9.1
Apr	0.0	66.4	17.6	7.1	0.0	2.4	6.5	22.7	15.3
May	0.0	64.7	20.9	5.7	0.4	3.3	7.7	19.5	-
Jun	0.0	39.3	44.8	5.0	1.0	3.2	6.5	16.1	14.0
Jul	0.0	47.4	37.7	5.5	0.0	3.0	6.3	17.9	12.5
Aug	0.0	35.4	54.3	5.6	0.1	3.1	1.4	10.0	14.1
Sept	0.0	31.6	62.5	5.5	0.0	2.8	0.0	5.2	19.2

* Not exposed to weather † Sampled from top of bed

TABLE C.IX

[illegible] 1

SINTERING TEMP, °C 1350

SINTERED AND WEATHERED MATERIAL COMPOSITION

% WEIGHT BASIS

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS	Metal Oxides	Free H_2O	Loss at 600°C under Nitrogen	
								Predicted	Observed
Sept*	83.4	0.0	0.3	10.3	5.9	4.1	0.0	-	-
Oct ‡	11.3	69.6	4.7	8.1	2.9	3.9	3.6	16.9	10.3
Oct 1	0.0	62.2	13.6	6.6	1.9	3.0	12.4	27.6	29.4
Nov	11.7	60.1	16.6	7.9	0.7	3.2	0.0	14.6	20.4
Dec †	0.0	14.8	67.5	6.1	3.8	2.2	5.5	9.1	20.4
Jan †	0.0	19.5	66.4	6.1	0.3	2.2	5.6	4.7	28.4
Feb	23.2	19.2	47.3	7.2	0.0	2.8	0.0	4.7	14.7
Mar	0.0	45.1	40.2	6.6	0.0	2.7	5.3	16.3	13.4
Apr	0.0	59.7	23.9	6.9	0.0	3.2	6.3	20.8	27.1
May	0.0	59.2	17.9	2.2	0.0	2.9	3.6	18.0	-
Jun	0.0	25.8	63.9	2.0	0.0	3.2	5.1	11.4	11.4
Jul	0.0	55.2	31.1	7.5	0.0	1.3	6.2	19.6	16.7
Aug	0.0	38.3	53.6	4.6	0.6	2.5	0.2	9.5	7.7
Sept	0.0	46.8	40.9	4.5	0.0	1.8	6.6	17.9	21.1

* Not exposed to weather † Sampled from top of bed

TABLE C. X

SINTERING TIME, hr 1

SINTERING TEMP. °C 1450

SINTERED AND WEATHERED MATERIAL COMPOSITION

% WEIGHT BASIS

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS	Metal Oxides	Free H_2O	Loss at 600°C under Nitrogen	
								Predicted	Observed
Sept*	80.6	0.0	0.2	10.6	4.5	4.1	0.0	0.0	4.5
Oct ½	17.6	61.8	7.6	8.2	1.4	3.4	0.0	16.5	12.3
Oct 1	0.0	63.1	15.9	6.9	2.4	2.2	9.4	24.7	25.8
Nov	0.0	73.0	10.9	7.4	1.7	2.9	4.1	21.9	18.0
Dec †	0.0	11.5	72.7	6.2	4.0	2.1	5.6	8.4	19.6
Jan †	0.0	12.6	74.1	6.0	0.2	2.2	5.0	8.0	20.9
Feb	0.0	72.3	12.3	7.2	0.0	2.6	5.5	23.1	21.6
Mar	0.0	48.3	36.6	6.7	0.0	2.5	5.8	17.6	11.9
Apr	0.0	56.3	27.0	6.8	0.0	3.4	6.6	20.3	16.9
May	0.0	55.5	30.1	4.9	0.2	3.2	6.2	19.6	17.2
Jun	0.0	28.2	67.7	2.0	0.5	2.7	0.0	6.9	9.6
Jul	0.0	55.3	31.1	2.0	0.0	3.6	7.9	21.4	19.4
Aug	0.0	35.8	57.5	4.9	0.2	2.5	0.0	7.8	11.1
Sept	0.0	48.0	40.9	8.0	0.0	3.0	0.0	5.5	22.0

* Not exposed to weather † Sampled from top of bed

TABLE C.XI

SINTERING TIME, hr 3

SINTERING TEMP, °C 1450

SINTERED AND WEATHERED MATERIAL COMPOSITION

% WEIGHT BASIS

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS	Metal Oxides	Free H_2O	Loss at 600°C under Nitrogen	
								Predicted	Observed
Sept*	87.2	0.0	0.2	10.5	2.4	4.2	0.0	-	-
Oct ½	23.7	60.2	2.8	8.4	1.4	3.4	0.0	14.6	9.8
Oct 1	0.0	76.6	6.3	7.4	2.3	3.0	4.3	22.9	23.8
Nov	0.0	71.9	11.4	7.3	1.6	3.4	4.4	21.9	14.7
Dec †	0.0	12.4	70.7	6.1	3.6	2.2	5.0	8.0	27.7
Jan †	0.0	18.6	65.0	6.0	0.8	2.0	7.6	12.1	17.6
Feb	0.0	73.2	16.1	7.6	0.0	2.5	0.6	18.4	18.3
Mar	0.0	36.1	50.2	6.5	0.0	2.5	4.6	13.4	20.7
Apr	0.0	67.6	15.5	7.0	0.0	3.4	6.5	20.9	23.2
May	0.0	60.6	24.5	5.0	0.4	3.2	6.2	21.0	23.0
Jun	0.0	35.8	56.6	2.0	0.4	3.0	2.2	10.9	12.7
Jul	0.0	46.1	41.8	4.8	0.0	2.7	4.6	15.8	17.0
Aug	0.0	50.1	38.4	4.9	0.0	2.7	3.9	16.1	9.8
Sept	0.0	21.9	72.9	4.7	0.0	2.6	0.0	5.0	18.3

* Not exposed to weather † Sampled from top of bed

TABLE C.XII

SINTERING TIME, hr 3

SINTERING TEMP. °C 1450

SINTERED AND WEATHERED MATERIAL COMPOSITION

% WEIGHT BASIS

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS	Metal Oxides	Free H_2O	Loss at 600°C under Nitrogen	
								Pre-dicted	Obs-erved
Sept*	87.6	0.0	0.2	10.5	1.9	4.0	0.0	-	-
Oct ʋ	18.5	62.5	3.8	8.3	3.3	3.6	0.0	15.2	11.7
Oct i	3.1	70.2	13.9	7.7	1.7	3.3	0.0	17.1	22.4
Nov	0.0	56.8	26.8	7.0	1.7	3.1	4.6	18.4	15.2
Dec †	0.0	0.0	87.5	6.0	2.5	2.1	0.0	0.0	21.1
Jan †	0.0	3.6	85.0	5.9	0.2	2.5	2.7	3.6	29.4
Feb	0.0	66.8	21.9	7.4	0.0	2.4	1.4	17.6	18.3
Mar	0.0	77.0	10.6	7.5	0.0	2.5	2.4	21.1	7.2
Apr	0.0	67.9	17.3	7.2	0.0	3.3	4.3	20.8	27.4
May	0.0	64.6	21.9	6.0	0.0	2.9	3.7	19.4	-
Jun	0.0	30.3	58.2	5.2	0.0	2.6	3.8	11.1	11.3
Jul	0.0	52.7	31.8	5.5	0.0	2.7	7.3	20.1	19.9
Aug	0.0	40.0	50.7	5.1	0.0	2.7	1.5	11.2	8.3
Sept	-	-	-	-	-	-	-	-	-

* Not exposed to weather † Sampled from top of bed

TABLE C.XIII

SINTERING TIME, hr 3

SINTERING TEMP, °C 1550

SINTERED AND WEATHERED MATERIAL COMPOSITION

% WEIGHT BASIS

Month	CaO	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	CaS	Metal Oxides	Free H_2O	Loss at 600°C under Nitrogen	
								Pre-dicted	Obs-erved
Sept*	87.1	0.0	0.2	10.4	1.9	4.1	0.0	-	-
Oct ½	14.0	69.1	2.5	8.2	2.8	3.4	0.0	16.8	11.1
Oct 1	0.0	70.6	13.7	7.4	2.4	3.1	2.8	20.0	30.4
Nov	2.6	54.9	30.7	7.3	1.3	3.2	0.0	13.3	19.0
Dec †	3.0	7.4	77.7	6.1	3.1	1.9	3.8	28.2	28.2
Jan †	0.0	6.2	81.4	5.9	0.2	2.1	4.1	5.7	29.0
Feb	5.8	51.6	32.3	7.4	0.4	2.5	0.0	12.0	17.5
Mar	0.0	62.1	26.4	7.3	0.0	2.5	1.9	17.0	7.8
Apr	0.0	55.2	30.6	6.9	0.0	3.4	4.0	17.5	11.2
May	0.0	53.6	36.1	5.3	0.0	2.9	2.1	15.1	-
Jun	0.0	48.0	36.1	5.1	0.0	2.5	8.3	20.0	12.3
Jul	0.0	52.0	37.7	5.1	0.0	2.5	2.8	15.4	23.1
Aug	0.0	44.7	47.3	5.4	0.0	2.7	0.0	10.9	11.8
Sept	0.0	42.0	44.5	6.2	0.0	2.6	4.8	15.0	19.5

* Not exposed to weather † Sampled from top of bed

TABLE C.XIV

SINTERING TIME, hr 4

SINTERING TEMP, °C 1350

SINTERED AND WEATHERED MATERIAL ANALYSES

% WEIGHT BASIS

Month	CaO Equivalent	CO_2	MgO	SiO_2	Fe	Al_2O_3	Na	Total S	V
Sept *	97.2	0.07	.9	1.1	.10	.8	.006	4.77	.69
Oct ½	73.0	3.24	.7	1.4	.08	.6	.007	3.38	.56
Oct 1	67.0	5.08	.8	1.0	.08	.4	.004	2.97	.55
Nov	68.5	5.4	.6	1.3	.13	.4	.002	2.64	.42
Dec †	55.1	28.1	.5	.4	.08	.3	.012	3.25	.37
Jan †	53.7	29.2	.5	.7	.08	.3	.054	2.03	.29
Feb	71.6	6.97	.6	1.2	.10	.5	.002	1.61	.19
Mar	60.8	20.2	.5	1.1	.09	1.9	.002	1.39	.17
Apr	63.0	7.75	.5	1.1	.08	.6	.002	1.57	.50
May	64.0	9.72	.5	1.1	.08	.6	.002	1.55	.48
Jun	58.7	19.7	.6	1.0	.10	.4	.008	1.68	.50
Jul	61.4	16.6	.6	.9	.10	.4	.002	1.86	.45
Aug	62.4	23.9	.6	.9	.10	.4	.002	1.38	.41
Sept	61.2	27.5	.6	1.1	.09	.5	.003	1.28	.37

* Not exposed to weather † Sampled from top of bed

TABLE C.XV

SINTERING TIME, hr 3

SINTERING TEMP, °C 1350

SINTERED AND WEATHERED MATERIAL ANALYSES

% WEIGHT BASIS

Month	CaO Equivalent	CO_2	MgO	SiO_2	Fe	Al_2O_3	Na	Total S	V
Sept*	92.4	0.1	.9	1.2	.10	.6	.007	5.06	.73
Oct ½	72.2	2.06	.7	1.1	.08	.5	.005	3.21	.57
Oct 1	58.9	5.99	.6	1.2	.08	.5	.004	2.98	.49
Nov	70.2	7.3	.7	1.2	.12	.4	.003	2.15	.41
Dec †	54.6	29.7	.5	.6	.08	.4	.002	3.14	.35
Jan †	54.6	29.2	.5	.7	.08	.4	.006	1.78	.30
Feb	67.3	20.8	.6	1.2	.09	.5	.002	1.45	.17
Mar	59.4	17.7	.55	1.0	.10	.6	.006	1.35	.23
Apr	61.4	10.5	.55	1.1	.08	.6	.003	1.12	.50
May	65.0	14.1	.5	1.1	.08	.6	.002	1.09	.47
Jun	57.3	28.1	.6	1.1	.11	.5	.005	1.06	.50
Jul	61.2	17.6	.6	.9	.09	.5	.002	1.20	.41
Aug	61.5	20.9	.6	.9	.09	.5	.002	1.09	.40
Sept	61.1	27.5	.6	1.1	.09	.4	.003	1.27	.35

* Not exposed to weather † Sampled from top of bed

TABLE C.XVI

SINTERING TIME, hr 1

SINTERING TEMP, °C 1450

SINTERED AND WEATHERED MATERIAL ANALYSES

% WEIGHT BASIS

Month	CaO Equivalent	CO_2	MgO	SiO_2	Fe	Al_2O_3	Na	Total S	V
Sept*	94.6	.07	.9	1.1	.09	.7	.003	4.50	.72
Oct †	73.1	3.35	.7	1.0	.09	.6	.003	3.37	.55
Oct 1	61.4	7.02	.6	1.1	.07	.4	.003	2.68	.50
Nov	65.7	4.80	.6	1.1	.12	.4	.001	2.47	.40
Dec †	55.1	32.0	.5	.6	.08	.3	.001	3.24	.34
Jan †	53.6	32.6	.5	.7	.08	.4	.005	1.47	.22
Feb	64.6	5.4	.6	.09	.09	.7	.002	1.71	.19
Mar	59.8	16.1	.5	.9	.10	.7	.001	1.54	.21
Apr	60.5	11.9	.5	1.2	.10	.7	.002	1.45	.50
May	61.0	13.4	.5	1.2	.10	.7	.002	1.24	.44
Jun	61.2	20.8	.7	1.1	.11	.5	.005	1.43	.50
Jul	61.3	13.7	.6	1.1	.10	.5	.002	0.93	.43
Aug	61.5	23.6	.6	1.1	.09	.5	.002	1.42	.38
Sept	59.7	18.0	.6	1.1	.10	.6	.002	1.21	.35

* Not exposed to weather † Sampled from top of bed

TABLE C.XVII

SINTERING TIME, hr 3

SINTERING TEMP, °C 1450

SINTERED AND WEATHERED MATERIAL ANALYSIS

% WEIGHT BASIS

Month	CaO Equivalent	CO_2	MgO	SiO_2	Fe	Al_2O_3	Na	Total S	V
Sept*	93.5	.1	.9	1.1	.11	.7	.003	4.81	.73
Oct ½	75.4	1.25	.7	1.0	.09	.6	.003	3.35	.58
Oct 1	66.4	2.78	.6	1.0	.08	.4	.002	2.78	.52
Nov	65.0	5.0	.6	1.4	.22	.5	.001	2.40	.40
Dec †	54.3	31.1	.5	.5	.08	.3	.008	3.05	.40
Jan †	53.6	28.6	.5	.6	.09	.3	.005	1.78	.30
Feb	67.5	7.08	.6	.9	.09	.6	.001	1.83	.18
Mar	58.1	22.1	.5	.9	.10	.7	.001	1.50	.19
Apr	62.7	6.8	.5	1.3	.09	.7	.001	1.58	.50
May	62.0	10.8	.5	1.3	.08	.7	.001	1.35	.46
Jun	61.2	24.9	.6	0.9	.10	.5	.003	1.36	.50
Jul	60.3	18.4	.6	1.1	.09	.5	.001	1.13	.41
Aug	61.4	16.2	.6	1.1	.10	.5	.002	1.22	.39
Sept	59.4	32.1	.6	1.1	.10	.5	.003	1.20	.35

* Not exposed to weather † Sampled from top of bed

TABLE C.XVIII

SINTERING TIME, hr 1

SINTERING TEMP, °C 1050

SINTERED AND WEATHERED MATERIAL ANALYSES

% WEIGHT BASIS

Month	CaO Equivalent	CO_2	MgO	SiO_2	Fe	Al_2O_3	Na	Total S	V
Sept*	93.5	.1	.9	1.1	.09	.7	.001	3.30	.68
Oct ‡	73.9	1.68	.8	1.2	.08	.5	.003	3.40	.58
Oct 1	68.6	6.13	.7	1.2	.07	.4	.002	2.60	.51
Nov	62.2	11.80	.6	1.1	.12	.4	.001	2.40	.47
Dec †	53.2	38.50	.5	.6	.07	.3	.007	2.50	.36
Jan †	52.9	37.40	.5	.7	.07	.3	.005	1.50	.29
Feb	65.8	6.95	.6	.9	.09	.7	.001	1.50	.18
Mar	67.3	4.65	.5	.9	.10	.7	.001	1.50	.19
Apr	64.0	7.60	.5	1.2	.09	.7	.001	1.70	.50
May	64.0	9.65	.6	1.2	.08	.6	.001	1.62	.44
Jun	57.6	25.6	.6	0.9	.11	.5	.003	1.23	.50
Jul	60.0	14.0	.6	1.1	.11	.5	.002	1.29	.42
Aug	60.8	22.3	.6	1.1	.09	.5	.002	1.21	.40
Sept	-	-	-	-	-	-	-	-	-

* Not exposed to weather † sampled from top of bed

TABLE C.XIX

SINTERING TIME, hr   3

SINTERING TEMP, °C   1550

SINTERED AND WEATHERED MATERIAL ANALYSES

% WEIGHT BASIS

Month	CaO Equivalent	CO_2	MgO	SiO_2	Fe	Al_2O_3	Na	Total S	V
Sept*	93.0	.07	.9	1.1	.10	.7	.001	3.30	.68
Oct ½	73.3	1.10	.7	1.0	.09	.5	.001	3.20	.63
Oct 1	66.0	6.07	.6	1.0	.07	.4	.001	2.80	.59
Nov	65.3	13.5	.6	1.4	.13	.4	.001	2.30	.41
Dec †	54.0	34.2	.5	0.4	.07	.3	.007	2.80	.36
Jan †	52.9	35.8	.5	.7	.08	.3	.006	1.50	.29
Feb	66.2	14.2	.6	.9	.09	.7	.001	1.90	.20
Mar	64.7	11.6	.5	.9	.09	.6	.002	1.70	.18
Apr	61.7	13.5	.5	1.2	.17	.6	.001	1.60	.50
May	63.0	15.9	.5	1.2	.10	.6	.001	1.05	.46
Jun	52.6	15.9	.6	0.8	.13	.5	.004	1.19	.50
Jul	58.8	16.6	.6	0.9	.09	.5	.001	0.93	.39
Aug	62.5	20.8	.6	1.1	.09	.5	.002	1.27	.41
Sept	59.2	19.6	.6	1.1	.10	.5	.002	1.47	.35

* Not exposed to weather † Sampled from top of bed

TABLE CXX.

SINTERING TIME, hr 1

SINTERING TEMP, °F 1950

ANALYSES OF SINTERED LIME LEACHATES

PARTS PER MILLION WEIGHT BASIS

Month	Rain-fall mm.	pH	Ca	Mg	Si	Fe	Al	Na	V
Sept*	-	No leachate							
Oct ½	59.7	No leachate							
Oct 1	59.7	8	440	1	6	≤.1	≤1	180	3
Nov	123.2	10	700	≤.1	13	- 1	≤1	7	1
Dec	79.6	10	1160	.3	1	≤.1	≤1	22	≤1
Jan	89.5	10	1500	.2	2	≤.1	≤1	15	≤1
Feb	88.9	10	1550	.2	2	≤.1	≤1	19	≤1
Mar	115.2	10	1300	.2	4	≤.1	≤1	18	≤1
Apr	35.9	10	1800	.3	2	.2	≤1	22	≤1
May	44.3	10	2300	.2	2	.2	≤1	25	≤1
Jun	5.3	10	1000	3.1	≤2	-	-	158	4
Jul	31.3	10	-	-	-	-	-	-	-
Aug	33.1	10	-	-	-	-	-	-	-
Sept	85.8	10	1410	.2	≤2	.2	≤1	30	1

* Not exposed to weather

TABLE LXII

SINTERING TIME, hr 3

SINTERING TEMP, °C 1350

ANALYSES OF SINTERED LIME LEACHATES

PARTS PER MILLION WEIGHT BASIS

Month	Rain-fall mm	pH	Ca	Mg	Si	Fe	Al	Na	V
Sept*	0	No leachate							
Oct *	59.7	-	235	6	11	<.1	<1	43	9
Oct 1	59.7	8	440	1	5	<.1	<1	139	2
Nov	123.8	10	640	<.1	11	<.1	<1	6	<1
Dec	79.6	10	2160	.3	1	<.1	<1	17	<1
Jan	29.5	10	1300	.1	2	<.1	<1	11	<1
Feb	88.9	10	1250	.2	2	<.1	<1	13	<1
Mar	115.6	10	1000	.2	7	<.1	<1	14	<1
Apr	35.9	10	1500	.1	4	.2	<1	17	<1
May	44.3	10	1900	<.1	1	<.1	<1	17	<1
Jun	5.3	10	2600	.5	<2	-	-	36	<1
Jul	31.3	10	-	-	-	-	-	-	-
Aug	33.1	10	-	-	-	-	-	-	-
Sept	85.8	10	1150	.1	<2	.2	<1	22	<1

* Not exposed to weather

TABLE C.XXII

SINTERING TIME, hr 1

SINTERING TEMP, °C 1450

ANALYSES OF SINTERED LIME LEACHATES

PARTS PER MILLION WEIGHT BASIS

Month	Rain-fall mm.	pH	Ca	Mg	Si	Fe	Al	Na	V
Sept*	-	No leachate							
Oct ½	59.7	9	153	12	4	≤.1	<1	88	9
Oct 1	59.7	10	390	1.5	5	≤.1	<1	125	8
Nov	123.8	10	600	.1	11	≤.1	<1	6	<1
Dec	79.6	10	2040	.2	1	≤.1	<1	11	<1
Jan	89.5	10	1300	≤.1	8	≤.1	<1	8	<1
Feb	88.9	10	1300	.1	8	≤.1	<1	11	<1
Mar	115.2	10	1100	.4	6	≤.1	<1	14	<1
Apr	35.9	10	1400	≤.1	4	.2	≤1	12	<1
May	44.3	10	1950	≤.1	1	≤.1	<1	14	<1
Jun	5.3	9	1700	.7	<2	-	-	21	4
Jul	31.3	9	-	-	-	-	-	-	-
Aug	33.1	9	-	-	-	-	-	-	-
Sept	85.8	9	875	≤.1	<2	≤.1	<1	16	<1

* Not exposed to weather

TABLE LXXIII

SINTERING TIME, hr 3

SINTERING TEMP, °F 1450

ANALYSES OF SINTERED LIME LEACHATES

PARTS PER MILLION WEIGHT BASIS

Month	Rain-fall mm.	pH	Ca	Mg	Si	Fe	Al	Na	V
Sept*	-	No leachate							
Oct ½	50.7	11	100	3	15	<.1	<1	25	5
Oct 1	59.7	10	310	1.5	5	<.1	<1	114	2
Nov	123.2	10	600	.2	11	<.1	<1	5	<1
Dec	79.6	10	1080	.1	1	<.1	<1	10	<1
Jan	29.5	10	1170	<.1	2	<.1	<1	7	<1
Feb	88.9	10	1100	<.1	2	<.1	<1	9	<1
Mar	115.2	10	900	.2	7	<.1	<1	12	<1
Apr	35.2	10	1400	.1	3	.2	<1	11	<1
May	44.3	10	1900	.1	[illegible]	<.1	<1	11	<1
Jun	5.3	10	2860	1.2	<2	-	-	21	3
Jul	31.3	10	-	-	-	-	-	-	-
Aug	33.1	10	-	-	-	-	-	-	-
Sept	85.8	10	1391	<.1	<2	.2	<1	16	<1

* Not exposed to weather

TABLE C.XXIV

SINTERING TIME, hr 1

SINTERING TEMP, °C 1550

ANALYSES OF SINTERED LIME LEACHATES

PARTS PER MILLION WEIGHT BASIS

Month	Rain-fall mm	pH	Ca	Mg	Si	Fe	Al	Na	V
Sept*	-	No leachate							
Oct ½	59.7	8	128	4	4	<.1	<1	24	14
Oct 1	59.7	10	960	1.5	6	<.1	<1	111	2
Nov	123.2	10	580	.2	10	<.1	<1	8	<1
Dec	79.6	10	1860	.8	1	<.1	<1	12	<1
Jan	29.5	10	1300	<.1	2	<.1	<1	8	<1
Feb	68.9	10	1100	<.1	4	<.1	<1	12	<1
Mar	115.2	10	750	.3	7	<.1	<1	11	<1
Apr	35.9	10	1500	<.1	3	.2	<1	13	<1
May	44.3	10	1900	<.1	1.0	<.1	<1	11	<1
Jun	5.3	9	1700	.5	<2	-	-	24	1
Jul	31.3	9	-	-	-	-	-	-	-
Aug	33.1	9	-	-	-	-	-	-	-
Sept	85.8	9	883	.1	<2	<.1	<1	15	<1

* Not exposed to weather

TABLE C.XXV

SINTERING TIME, hr 3

SINTERING TEMP, °C 1550

ANALYSES OF SINTERED LIME LEACHATES

PARTS PER MILLION WEIGHT BASIS

Month	Rain-fall mm	pH	Ca	Mg	Si	Fe	Al	Na	V
Sept*	-			No leachate					
Oct ½	59.7			No leachate					
Oct 1	59.7			No leachate					
Nov	123.2	9.5	840	.2	10	<.1	<1	7	<1
Dec	79.6	10	2040	.4	1	<.1	<1	12	<1
Jan	29.5	10	1320	.1	2	<.1	<1	8	<1
Feb	88.9	10	1500	<.1	3	<.1	<1	11	<1
Mar	115.2	10	900	.2	5	<.1	<1	10	<1
Apr	35.9	10	1750	.1	3	.2	1	18	<1
May	44.3	10	1900	.1	1	<.1	<1	14	<1
Jun	5.3	8	1700	.7	<2	-	-	40	1
Jul	31.3	8	-	-	-	-	-	-	-
Aug	33.1	8	-	-	-	-	-	-	-
Sept	85.8	8	1110	.1	<2	.2	<1	24	<1

* Not exposed to weather

APPENDIX D

Sulphation Test Results

Page

Details of Sulphation Tests. 185

Data for Sulphation Runs, Tables D.I to D.XI 189

Cumulative Solids and Sulphur Balances, Tables D.XII to D.XIV 200

DETAILS OF SULPHATION TESTS

The exit gas from the sulphator was sampled continuously, passed through a filter and a water condenser, and monitored directly for CO_2, O_2, and SO_2. The plenum dry gas analysis for O_2 and SO_2 was similarly obtained.

The SO_2 absorption efficiency was calculated as shown below:

$$\%\ SO_2 \text{ absorption} = \frac{\text{gm. moles } SO_2 \text{ absorbed}}{\text{gm. moles } SO_2 \text{ input}} \times 100$$

$$= \frac{\text{gm. } SO_2 \text{ in} - \text{gm. } SO_2 \text{ out}}{\text{gm. } SO_2 \text{ in}} \times 100$$

$$= 100 - \frac{\text{Vol.\% } SO_2 \text{ in exit gas} \times \rho \times \phi}{\text{Flow rate } SO_2 \text{ input, gm./min.}}$$

The SO_2 input rate was determined by noting the weight of the SO_2 cylinder and contents at regular intervals.

ρ = density of SO_2, gm./l

The flow rate of exit gases from the sulphator, ϕ l/min., was calculated from a nitrogen balance.

$$\phi = \frac{79 \times \text{Total air into unit} + 100 \times \text{Nitrogen purges}}{\text{Vol.\% nitrogen in exit gases}}$$

The vol.% nitrogen in the exit gases was calculated by difference from the CO_2, O_2, and SO_2 analyses.

The Ca : S molar feed rate was calculated as shown below:

Molar Ca in feed : SO_2 input

$$= \frac{\text{gm. mols. CaO fed}}{\text{gm. mols. } SO_2 \text{ input to sulphator}}$$

$$\frac{\text{gm./min. CaO fed}}{\text{gm./min. SO}_2\text{ input}} \times \frac{64}{56}$$

The spent lime feed was calculated in terms of equivalent burned stone, CaO, as follows:

$$\text{gm. CaO} = \text{gm. spent lime} \times (1 - 0.01 \times C - 0.00501 \times S - 0.01996 \times SO_4)$$

where C = total carbon, % wt.

S = total sulphur, % wt.

SO_4 = total sulphur present as sulphate, % wt.

The mean particle diameters were determined by use of the formula:

$$\frac{100}{\text{Mean particle diameter}} = \sum \frac{x}{D_x}$$

where x = % wt. of particles of diameter D_x

The mole % sulphation was defined as:

$$\text{Mole \% sulphation} = \frac{\text{moles CaSO}_4\text{ in sample}}{\text{total moles Ca combined in sample}} \times 100$$

$$= \frac{\text{moles S present as SO}_4}{\text{moles total S + moles CaO}} \times 100$$

$$= \frac{\frac{SO_4}{32}}{\frac{S}{32} + \frac{CaO}{56}} \times 100$$

$$= \frac{SO_4}{S + CaO \times 0.5714} \times 100$$

where S = total sulphur, % wt.

SO_4 = total sulphur present as sulphate, % wt.

CaO = calcium oxide, % wt.

For mole % sulphation of sieved fractions of bed or cyclone material analyses were obtained for these fractions directly.

Corrections were made for oxide impurities such as SiO_2, Fe_2O_3, and Al_2O_3 present in the sulphated spent lime. Each sample was also analysed for acid insolubles to determine the % by weight of silicon carbide present, and a correction applied. These corrections are best illustrated by several examples.

(i) Sulphation run no. 3 bed material 250-150 microns at 630 min.
S = 17.5% wt., SO_4 = 17.5% wt., C = <0.01% wt.
Acid insolubles = 2.3% wt.

% wt. CaO in sample = 100 - % wt. $CaSO_4$ - % wt. CaS - % wt. C
- % SiC - % wt. oxide impurities

Oxide impurity in burned stone = 3.4% wt.

Equivalent burned stone = 100 - C - 0.501 x S - 1.996 x SO_4
as percent of sample = 56%

Therefore % wt. oxide impurity in sample = $3.4 \times \frac{56}{100}$ = 1.9%

% Silicon carbide = % Acid insolubles observed - % Acid insolubles in spent lime

Acid insolubles in burned stone = 1.5% wt.

Therefore % SiC = $2.3 - 1.5 \times \frac{56}{100}$ = 1.5% wt.

% CaS = 0 ; % $CaSO_4$ = $\frac{SO_4}{96} \times 136$ = 74.5%

Therefore % CaO = 100 - 74.5 - 1.9 - 1.5 = 22.2

% mole sulphation = 58.1%

(ii) Sulphation run no. 3 bed material 600-250 microns at 15 min.
S = 1.0% wt., SO_4 = 1.0% wt., C <0.01% wt.
Acid insolubles = 89.2% wt.

The bulk of this sample is silicon carbide so % acid insolubles in the ~11% spent lime is negligible.

% SiC = % acid insolubles = 89.2%

SO_4 in spent lime = SO_4 in sample x $\frac{100}{100 - \% SiC}$

SO_4 corrected for SiC present = 9.6%

Therefore % $CaSO_4$ in spent lime = 40.9%

% CaO in spent lime = 100 - % $CaSO_4$ in spent lime = 59.1%

% Mole sulphation = 22.2%

TABLE D.1 : SULPHATION RUN NO. 3

SPENT LIME CHARGED: 4 KGM OF MEAN PARTICLE DIAMETER 356 MICRONS

SILICON CARBIDE CHARGED: 40 KGM

	% BY WEIGHT
$CaSO_4$	17.0
CaO	4.0
C	0.2

TIME PERIOD MIN.	BED TEMPERATURE °C	SUPERFICIAL GAS VELOCITY m/s	PLENUM VOL.% SO_2	% SO_2 ABSORPTION	% MOLE SULPHATION		
					CYCLONE MATERIAL <250 MICRONS	BED MATERIAL MICRONS 600-850	BED MATERIAL MICRONS 250-350
0-15	980 ± 5	1.1 ± 0.1	8.0 ± 0.5	62 ± 2	11.3 ± 1.0	23.0 ± 2.0	34.7 ± 1.0
15-75	969 ± 26	1.0 ± 0.1	5.4 ± 1.0	-	34.1 ± 1.0	-	-
75-135	982 ± 17	1.5 ± 0.08	4.6 ± 1.3	24 ± 4	44.1 ± 1.0	29.1 ± 2.2	49.1 ± 1.5
135-195	938 ± 4	1.81 ± 0.04	4.3 ± 1.0	-	48.0 ± 1.0	-	-
195-255	943 ± 18	2.0 ± 0.1	4.6 ± 0.4	-	48.3 ± 1.0	25.4 ± 2.0	50.6 ± 2.0
255-315	977 ± 9	1.9 ± 0.1	4.4 ± 0.4	20 ± 4	48.4 ± 1.0	-	-
315-375	954 ± 14	1.61 ± 0.07	4.4 ± 0.4	32 ± 6	48.3 ± 1.0	-	-
375-420	949 ± 6	1.4 ± 0.2	5.1 ± 0.3	41 ± 6	-	31.3 ± 2.0	53.6 ± 1.5

[illegible]

[illegible]: [illegible]
356 MICRONS

[illegible]: 40 [illegible]

	% BY WEIGHT
$CaSO_4$	27.0
CaS	4.0
C	0.5

TIME PERIOD MIN.	BED TEMPERATURE °C	SUPERFICIAL GAS VELOCITY m/s	[illegible] VOL.% SO_2	% SO_2 ABSORPTION	% [illegible]		
					CARRYOVER MATERIAL <250 MICRONS	BED MATERIAL MICRONS 600-250	250-150
480-590	908 ± 45	1.2 ± 0.2	8.6 ± 1.0	-	-	-	58.6 ± 1.5
590-630	960 ± 10	1.3 ± 0.05	7.6 ± 1.0	8 ± 2	-	36.8 ± 2.0	58.1 ± 1.5

[illegible]

[illegible]

	% BY WEIGHT
[illegible]	2.5
[illegible]	21.6
[illegible]	21.3

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
						ALL	[illegible]	[illegible]	[illegible]	[illegible]
0-30	[illegible] ± 33	0.58 ± 0.05	2.2 ± 0.2	5.3 ± 0.3	3 ± 1	27.5 ± 0.3	-	-	28.5 ± 1.0	28.8 ± 1.0
30-75	[illegible] ± 28	0.59 ± 0.07	2.1 ± 0.2	10.4 ± 0.2	58 ± 11	25.6 ± 1.0	-	-	24.7 ± 1.0	26.5 ± 1.0
75-105	[illegible] ± 3	0.53 ± 0.12	2.7 ± 1.3	10.9 ± 0.4	90 ± 10	27.4 ± 0.3	-	-	25.3 ± 1.0	26.7 ± 1.0
105-177	[illegible] ± 19	1.47 ± 0.08	1.6 ± 0.2	10.9 ± 0.4	99 ± 20	28.3 ± 0.8	-	-	28.5 ± 1.0	27.8 ± 1.0

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0-30	955 ± 17	1.05 ± 0.01	0.5 ± 0.1	7.9 ± 0.1	47 ± 2	-	-	-	25.6 ± 1.0	22.4 ± 1.3
30-75	980 ± 48	0.53 ± 0.07	2.6 ± 0.2	10.9 ± 0.4	58 ± 10	-	-	-	26.0 ± 1.0	22.0 ± 1.3
75-120	897 ± 17	0.46 ± 0.03	1.7 ± 0.2	11.5 ± 0.5	59 ± 8	-	-	-	37.8 ± 1.0	30.0 ± 1.3

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0-30	107 ± 6	1.55 ± 0.09	2.3 ± 0.1	7.3 ± 0.1	9 ± 4	22.5 ± 1.0	–	15.0 ± 1.0	20.3 ± 1.7	28.4 ± 1.8
30-60	122 ± 10	1.58 ± 0.08	2.5 ± 0.2	7.1 ± 0.3	13 ± 2	20.5 ± 1.0	–	32 ± 4	35 ± 7	33 ± 3.6
60-120	125 ± 5	1.6 ± 0.2	1.6 ± 0.7	7.4 ± 0.1	13 ± 2	23.0 ± 1.0	–	37 ± 3	38 ± 1	31 ± 2

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	–	–	[illegible]	[illegible]
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						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0-30	[illegible] ± 3	1.2 ± 0.2	5.7 ± 0.2	5.2 ± 0.1	90 ± 5	-	-	[illegible] ± 1.0	[illegible] ± 1.0	[illegible] ± 1.0
[illegible]	[illegible] ± 3	0.9 ± 0.1	3.6 ± 0.2	[illegible] ± 0.1	95 ± 5	-	-	[illegible] ± 1.5	[illegible] ± 1.0	[illegible] ± 1.0

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0-5	89 ± 7	1.1 ± 0.1	2.0 ± 0.3	7.0 ± 0.2	67 ± 10	28.0 ± 0.5	–	–	–	–
5-20	95 ± 5	0.80 ± 0.05	1.1 ± 0.4	7.6 ± 0.3	67 ± 5	28.5 ± 0.5	–	–	–	–
20-35	91 ± 7	0.9 ± 0.1	1.5 ± 0.4	7.3 ± 0.6	59 ± 10	21.6 ± 0.7	–	–	–	–
35-70	93 ± 10	0.57 ± 0.05	4.2 ± 0.8	2.7 ± 0.1	81 ± 9	28.0 ± 0.7	–	–	–	–

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						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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CUMULATIVE SOLIDS AND SULPHUR BALANCES

A comprehensive solids and sulphur balance check was made for all runs. Where silicon carbide was involved, both spent lime and silicon carbide balances were checked. The sulphur, spent lime, and silicon carbide recovery was in the region of 85-90%, 90%, and 95-100% respectively.

An illustration of the approach used in the cumulative solids and sulphur balances is given in Tables D.XII to D.XIV, based on data for sulphation run no. 10.

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TABLE 1.XIV - CUMULATIVE SULPHUR BALANCE FOR RUN NO. 10

GM. ATOMS

TIME, MIN.	SULPHUR IN, CUMULATIVE			SULPHUR OUT, CUMULATIVE				BED SULPHUR		% SULPHUR RECOVERY
	SO_2	FEED	TOTAL	CYCLONES	SCRUBBER	SO_2	TOTAL	CONTENT	CHANGE	
30	11.8	4.6	16.4	0.9	8.2	2.2	11.3	82.2	5.1	100
60	23.6	10.5	34.1	1.2	12.2	2.4	15.8	94.6	17.6	98.0
90	35.4	17.7	53.1	2.5	16.0	2.4	18.5	103.3	26.3	84.3
120	47.2	26.4	73.6	5.8	45.1	2.5	53.4	87.5	10.5	86.7
150	59.1	30.6	89.7	9.4	48.7	2.6	60.8	97.3	13.3	82.5
180	70.9	36.7	107.6	11.7	53.2	2.8	67.7	98.6	21.6	83.0
210	88.1	44.6	132.8	13.6	85.9	2.9	102.4	88.9	11.9	86.1
240	105.4	51.1	157.1	16.9	85.9	3.0	105.9	106.4	31.4	87.4
270	122.7	54.9	177.6	20.4	87.8	8.8	117.6	116.0	39.0	87.9
300	139.9	57.1	197.1	23.3	124.1	15.3	162.7	96.8	9.8	87.5
330	177.8	59.6	237.4	31.7	126.8	41.9	200.5	86.7	9.7	88.5
360	236.3	62.6	299.0	43.9	129.5	67.5	240.9	88.2	11.2	84.3

APPENDIX E

PILOT PLANT MODIFICATIONS

Page

Modifications prior to Run 8 205

- General
- Gasifier
- The bottom F.O. injector
- Gasifier lid
- Regenerator
- Cyclones
- Cyclone drains and fines return
- Steam
- Duct and burner
- Various

Modifications prior to Run 9 208

- Gasifier
- Gasifier lid
- Regenerator
- Cyclones and fines return
- Steam/Nitrogen
- Various
- Pre-run explosion repairs

PILOT PLANT MODIFICATIONS

To extend the range of operating conditions (e.g. higher bed velocity, deeper bed, etc.) considerable modifications were carried out before runs 8 and 9. Moreover, runs 5, 6 and 7 had pinpointed several areas of unreliability of the peripheral equipment while our growing experience had pointed to several potential improvements.

Modifications prior to Run 8

General -

The monolith block was raised 10" (25 cm) to improve access to the plenums and to allow more up and down movement to the bottom injector. An extra 36 inches (91 cm) of refractory was added to the top of the monolith block to allow an operation with deeper beds without flooding the cyclones with stone.

Gasifier -

The gasifier bed area was reduced from 4.50 sq. ft. (0.42 m^2) to 3.28 sq. ft. (0.30 m^2) by the addition of 5 sleeving blocks in the right hand side of the gasifier cavity. The blocks were keyed to each other and held back by stainless steel bars through the right hand gasifier wall. The second block from the bottom was cast from C1800 refractory while the remainder were cast in C1600; this arrangement served as a comparison of the relative merits of the two refractories. The addition of the blocks reduced the internal dimensions of the gasifier cavity to 17.5 inches x 27 inches (44.5 cm x 68.5 cm) at the bottom and 19.5 inches x 28 inches (49.5 cm x 71 cm) in the parallel portion from the original dimensions of 17.5 inches x 37 inches (44.5 cm x 94 cm) and 19.5 inches x 39 inches (49.5 cm x 99 cm) respectively. As a consequence of this change of dimension; the gasifier thermocouples were lengthened and relocated (they passed through the sleeving blocks) in order to measure temperatures at the same depths as in the previous runs, the right hand fuel oil injector was blanked off and the air distributor was fitted with 24 nozzles instead of 32 used previously. The air nozzles were of the same design as used in runs 6 and 7 but the orifices were bored out to give a cold air flow of 260 s.c.f.m. at 10 inches w.g. (440 m^3/h at 2.5 kPa) instead of 350 s.c.f.m. at 15 inches w.g. (590 m^3/h at 3.75 kPa) in the run 7 configuration. These changes were a compromise solution to provide reasonable performance at both 4 and 6 ft/sec. (1.22 to 1.83 m/sec.) bed velocity and at both high and low bed depths. The position of the fines return to the gasifier was changed to inject fines into the gasifier to regenerator transfer pocket; the fines return duct was lined with a 2" I.D. silicon carbide pipe and nitrogen was used to transfer the fines.

The bottom F.O. injector -

The bottom fuel oil injector was placed centrally in the bottom of the gasifier bed and had six horizontal holes, 7/64" dia. (2.8 mm) equally spread around the circumference at the hot end and could be moved up and down about 24 inches (61 cm). The bottom injector was piped in to take oil or kerosene from one, two or three pumps and in addition, the oil to it could be by-passed through a Kenic mixer which could also be fed with up to 45 I.gal./hr (204 litres/hr) of warm water. This arrangement was intended to try water (in an oil/water emulsion form) as a process temperature moderator and to compare it with flue gas recycle.

Gasifier lid -

The gasifier lid was modified to fit the new gasifier geometry. It was also provided with 5 new penetrations: four of these were for 1 1/16" (27 mm) Firebird Blue tubes, with their bottom ends sealed and 4" deep x 180° cut-outs in their sides, for injecting air under the lid, and the fifth one for inserting a silicon carbide sample tube, through a nitrogen purged lock chamber, into the gasifier top space to determine the rate of deposition of carbon at the cyclone entry.

Regenerator -

The top 36" of the regenerator was cast in C/850 refractory. It was also made wider i.e. 11" for 17" (28 cm for 43 cm) to reduce the fines removal from the regenerator. The regenerator distributor was modified to include a stainless steel coned top with a central drain coming out through the bottom of the regenerator air pipe, to facilitate easy removal of the regenerator bed.

Cyclones -

In raising the gasifier top level 36" (91 cm) an opportunity was taken to re-cast the gasifier cyclones in Durax C/850 high alumina refractory. The design of the cyclones themselves remained identical but the cyclone inlets were siamesed and provided with trumpet bell inlets. Because the gasifier cavity had been partly closed off, the cyclone entries (being symmetrically arranged in the original wall) were offset to one side. The cyclone drains were both arranged straight through with no internal connections to transfer passages. The seals were effected by lining the relevant parts of the cyclone drain legs with 2" I.D. (5 cm) silicon carbide pipes.

Cyclone drains and fines return -

Both cyclones were drained externally with no internal connections. Since the pneumatic logic control systems caused many problems during the previous test run, they were replaced by two electro-pneumatic control systems in which the sequencing was done by electric timers and pressure switches which, in turn, caused solenoid valves to trip and pressurise the appropriate actuator connections. The only portions of the pneumatic logic which were retained were the two knife oscillators; these were arrangements of five pneumatic miniature valves which provided a pulsed 80 psig (554 kPa) output when energised by a steady 80 psig input. The actual arrangement of the cyclone drain and fines return system were as follows: the vertical cyclone drain leg terminated at the lower end in a 1½ inch (38 mm) plug valve with a double acting air cylinder activator. Below the plug valve was a conical pressure vessel (fitted with a chunk trap) at the bottom of which was the fines off-take pipe fitted with gas knife connections. The 1½ inch (38 mm) fines off-take pipe led vertically up to well above the top of the gasifier where it terminated in a 1½ inch (38 mm) ball valve with graphite seats and a double acting air activator. This terminated the solids lift system. Downstream of the ball valve the two pipes (from the two cyclone drains) discharged into an inclined hopper which fed an elutriator. Fines from the top of the elutriator passed to a bag filter while the coarser material passed down through a plug valve and a flow limiting restrictor to an injector into the gasifier. The plug valve was air activated and set to open when the head of solids above it exceeded an adjustable pre-set height.

Steam -

Steam was connected, through a meter, to the plenum and also to a 2 inch (50 mm) pipe in the upper part of the left hand wall of the gasifier. Injection of steam into the plenum was intended to allow a comparison of steam, as a gasifier temperature moderator, with recycled flue gas and with water in the fuel oil/water emulsion. Provision of steam injection into the upper part of the gasifier was for an attempt on an on-stream steam/air burn out of carbon deposited in the cyclone inlets and cyclones.

Duct and burner -

The cyclone off-take and gas duct was of the same basic design as used previously with swept bends and Durax C1600 refractory lining enclosed with calcium silicate slab insulation within a square steel casing. The actual geometry was modified to conform with the changes in configuration of the unit. The burner premix section has been shortened by 2 inches (50 mm) also to conform with the changes in the geometry of the unit.

Various -

The shooter which was used to test the effect of shooting stone at cyclone inlets was removed from the unit. A high water level alarm was installed on the flue gas recycle scrubber.

A provision was made to inject a controlled and measured rate of SO_2

into various parts of the plant to check out the sampling systems.

Modifications prior to Run 9

Gasifier -

The top sleeving block was removed and the second one down was recast with the top sloping at 45°. The top part of the gasifier cavity was thus expanded back to its original width of 36 inches (90 cm) and cyclone inlets were once again symmetrically disposed in the gasifier back wall.

Gasifier lid -

The gasifier lid was re-cast to conform with the dimensions of the top of the gasifier cavity. It was fitted with 6 air injectors (of the same type as in run 8) capable of injecting a total of 53 s.c.f.m. (1500 litre/min) of air just under the gasifier lid. The actual air flow was measured with a low pressure drop rotameter.

Regenerator -

The regenerator design remained the same as in run 8.

Cyclones and fines return -

The cyclones remained unchanged but the fines return system had several small but important modifications: at the bottom of the cyclone drain two valves were installed in series (a butterfly valve and a plug valve) both 1½ inches (38 mm), with a vent controlled by a ½ inch (12 mm) valve between them. All three were pneumatically operated. The operating sequence was: the butterfly valve closed, then after a few seconds' delay the plug valve closed and the pressurisation sequence started to transfer the fines, then the plug valve and the vent valve opened, the vent valve shut and, last, after a few seconds' delay, the butterfly valve open. This sequence was intended to ensure a good seal at the bottom of the cyclone during the fines transfer, actuation of the plug valve with no solids load and avoidance of intermittent puffs of gas in the cyclone drain. The unreliable pneumatic knife pulsers were replaced by electric pulse generators and solenoid valves. At the bottom of the elutriator the flow limiting restrictor was replaced by a pulsed solids flow controller in which the downward flow of solids was prevented by a flat plate and initiated by pulses of nitrogen directed across the plate.

Steam/nitrogen -

Steam connections to the plenum and side of the gasifier were retained for this run and, in addition, nitrogen was connected to the 2 inch (50 mm) steam pipe in the upper part of the left hand side of the gasifier. This connection, in conjunction with the large volume of air injection through the lid allowed another attempt on an on-stream steam/air or nitrogen/air burn-out of carbon. An addition of a small bleed of nitrogen to the plenum and the above provisions made it possible to attempt slumped bed burn-outs using steam/air, nitrogen/air or flue gas/air and without sulphiting the gasifier bed.

Various -

The Kemix mixer for providing an emulsion of fuel oil and water was disconnected for this run.

Sight glasses were installed over the cyclone offtakes and over the gasifier.

Provisions were made for the injection of SO_2 and H_2S into the gasifier. Boiler gas sampling probe was installed in parallel with the existing sampling system and a refrigerator was installed to cool the sample rapidly and to condense out the water so that a dry gas sample was pumped to the analysers in the control room.

Pre-run explosion repairs -

Just before the start of Run 9 a propane/air explosion inside the gasifier blew off the lid and caused some minor damage to the refractory. The lid was repaired with Durax C1600 refractory and the gasifier refractory cracks were sealed with Sairset. None of the unit modifications or main features were affected.

APPENDIX F

CAFB RUN 8

Operational Log, Inspection & Data

		Page
Summary of Operational Log, Run 8		211
Inspection, Run 8		218
Figures F-1 to F-17		223
Table I	Temperatures and Feed Rates	234
Table II	Gas Flow Rates	246
Table III	Pressures	258
Table IV	Desulphurisation Performance	270
Table V	Gas Compositions	282
Table VI	Sulphur and Stone Cumulative Balance	297
Table VII	Solids Removed (Raw Data)	310
Table VIII	Solids Removvd (Analysis for Total Carbon)	321
Table IX	Solids Removed (Analysis for Sulphate Sulphur)	324
Table X	Solids Removed (Analysis for Total Sulphur)	326
Table XI	Sieve Analyses : Gasifier, Regenerator & Elutriator	328
Fig. F-18	Chronological Plot of Unit Performance	337
Fig. F-19	Chronological Plot of Gas Space Pressure	339

SUMMARY OF OPERATIONAL LOG, RUN 8

25.5.74 to 30.5.74 (Unit Warm Up)

Warm up of the unit started at 16.00 on 25.5.74, and initially the temperature was held around 100°C for six hours to allow new concrete to gently dry out. Thereafter the temperature was raised progressively by about 10°C per hour until 500°C, held at this temperature for six hours, and then increased again at the same rate.

Kerosine was added at 06.00 on 29.5.74, and limestone addition began at 19.35. This was switched over to fuel oil combustion some thirty minutes before gasification at 08.55 on 31.5.74.

Throughout the period of warm up the usual minor teething problems occurred, in particular several start-up burner flame outs due to condensation of water on the flame fire-eye. This highlighted the need for N_2 purges to the fire-eyes to prevent condensation.

31.5.74 (Day 1 of Gasification)

Successful start-up on gasification leading to only a few minor problems relating to the cyclone drain system and a leak in the gasifier lid.

Main effort of the day was concentrated on ensuring correct calibration and operation of the analytical equipment. The flue gas CO_2 meter was found to be unreliable, and the regenerator SO_2 meter initially appeared to need recalibration but was later found to be faulty and replaced.

The R.H. cyclone fines return system gave some problems during the day, but these were ironed out by the evening.

1.6.74 (Day 2)

More teething problems were encountered on the second day of gasification. Particularly troublesome were the cyclone drain systems which continually blocked throughout the day. The problem seemed to be that with relatively deep beds (~90-100 cm) and high fluidising velocities (~1.3 m/sec.) a large amount of material was carried over into the cyclones and the fines return system failed to cope.

Some problems with the Westoff SO_2 meter and regenerator/gasifier ΔP control valve were overcome, and leaks in the propane line to warm-up burner were identified and cured.

2.6.74 (Day 3)

Initially the system was operated at high bed velocity (~1.4 m/sec.) and molar stone feed rate, but bed depth could not be maintained and it was evident that a lot of fines was going over to the back of the boiler. Bed depth stabilised at about 75 cm. The fines return systems were overworked and prone to failure.

The desired condition of high bed velocity and a deep bed seemed unattainable and attempts were made to build bed depth at lower bed velocities.

3.6.74 (Day 4)

Early in the day a flow check of the fines return system was carried out. At a mean cyclone temperature of approximately 410°C about 42 kg/hour of material was calculated to be circulating.

Another day of continual problems from the fines return system.

4.6.74 (Day 5)

A comparatively quiet morning was interrupted by a power failure at 09.18 which caused automatic shutdown of the unit. Gasification recommenced at 09.53.

In all an uneventful day with much less trouble from the fines return system. Generally the performance of the unit in terms of % SRE seemed worse than in previous runs. Major differences in operation identified were:-

- Low stone feed.
- High regenerator air rate

- Higher gasifier temperature

It was decided to return to a molar stone feed rate and reduce gasifier temperature.

5.6.74 (Day 6)

Repairs to the cyclone drain control equipment were carried out and the stone feed system was cleaned out. The improved performance of the stone vibrator after cleaning resulted in a short period of extremely high stone addition (Ca/S mole ratio ~ 15). This was reflected in a drop in gasifier temperature. Pilot flame failure occurred due to a dirty fire-eye.

Poor regenerator performance was experienced throughout the day. A low regenerator air rate was set and a high CO_2 and low SO_2 off gas was obtained. Poor O_2 utilisation in the regenerator was improved by deepening the bed.

6.6.74 (Day 7)

Quiet morning with the unit operating well until the HT cyclone blocked and the pilot flame failed more or less simultaneously.

A silicone carbide probe was inserted in gasifier lid tapping (weight 104 grams), removed after four hours and found to be partly covered with a layer of carbon (weight of carbon ~1.2g) which readily flaked off. The object of the test was to try to measure the rate of lay down of coke above the bed, but some of the carbon had obviously been removed while extracting the probe, and this method was deemed unsatisfactory.

Tests with steam injection to the plenum air were started at 16.36 and continued till shortly after midnight. The flue gas rate was decreased to compensate for the drop in gasifier temperature. The immediate effect of steam injection was a considerable drop in desulphurising performance.

7.6.74 (Day 8)

Usual problems of cyclone, stone feed hopper and regenerator sampling line blockages. Otherwise uneventful.

8.6.75 (Day 9)

The stone feed system was particularly troublesome on this day with fine material blocking the vibrator. At one stage a large amount of this fine material was added to the gasifier causing a drop in gasifier temperature by 25°C and a considerable improvement in % RHE. More problems were experienced with the fine control system hardware.

The gas space pressure was now high, and a steam/air burn out was attempted by injecting above the bed while still gasifying. After several hours no obvious benefit was indicated by this approach and a switch was made to the conventional sulphation and slumped bed decoke.

9.6.75 (Day 10)

After the sulphation and slumped bed decoke the unit was re-started on kerosine at 07.00 to raise bed temperature. The cyclone chunk traps were drained and large pieces of coke removed. The boiler was inspected and several rows of tubes were found to be solidly blocked with deposits, and these were removed.

Later the RH cyclone drain activator became faulty causing a blockage in the system. This was replaced and the unit shut down to rod out the cyclones and again clean the chunk traps.

Further troubles with the cyclone drain system were ironed out and gasification was started at 22.00.

10.6.75 (Day 11)

At 07.30 the fuel supply was switched to a new tank and this apparently caused a pressure rise in the centre fuel pump sufficient to activate the relief valve starving the unit of fuel. Bed temperature increased rapidly followed by flame out and an emergency shut down.

At this point contact with the fuel storage depot revealed that a leak in a steam coil had caused their fuel delivery to us to be heavily contaminated with water. A quick analysis of the fuel supply indicated that about 10 wt.% water contamination was present. Later analysis indicated more than 25 wt.% contamination.

11.6.74 (Day 12)

At 00.30 an attempt to gasify failed due to the re-occurrence of high pressure on centre fuel pump. A switch to the LH fuel pump resulted in a successful start-up on gasification at 02.00.

More evidence of water contamination came from the fact that a high oxygen content in the flue gas was obtained while operating at an apparently high fuel rate. Furthermore copious amounts of water vapour was coming from the stack. The carbon level on the stone was also low due to the presence of water. Indeed a gasifier bed sample taken at this time showed the stone almost completely white. Poor regenerator performance was evident throughout this period.

Detailed analysis of the fuel oil used over the period indicated nearly 20 wt.% water contamination. A change to another supply tank was made which reduced the contamination level to 10 wt.%.

12.6.74 (Day 13)

A switch to another supply tank at 02.45 resulted in an increase in flue gas oxygen level, and indicated this new supply was also heavily water contaminated.

This time it was obvious that water contamination had a considerably adverse effect on desulphurising performance. Meanwhile arrangements were in hand to obtain fuel supplies free from water contamination.

13.6.74 (Day 14)

Throughout the last few days periodic checks on fuel water content were made and the levels were progressively reduced. At 06.00 the water level was 6.4 wt.%.

14.6.74 (Day 15)

Some problems with fines return system and stone feed hopper. Otherwise uneventful day with a much improved desulphurising performance due to lower water level in the fuel.

15.6.74 (Day 16)

A short test on the rate of stone circulation to cyclones gave a figure of 111 kg/hour for a mean cyclone temperature of about 500°C. More trouble with the RH cyclone drain actuator necessitated manual operation. Desulphurising performance was pour at this point (06.20) and it was decided until conditions were more stable to revert to gasification with wet fuel (~6.0 wt.% H_2O) to save the limited supply of dry fuel oil (0.2 wt.% H_2O) available.

At 12.05 a switch to dry fuel oil was made and this gave only a slight improvement in flue gas SO_2 levels.

At 22.50 the performance of the regenerator deteriorated showing high levels of CO_2 and low levels of SO_2. Attempts to improve the situation were unsuccessful.

16.6.74 (Day 17)

The poor performance of the regenerator continued throughout the day. The regenerator CO_2 meter went off scale while the SO_2 meter read zero. A possible explanation was that operating conditions in the gasifier were too rich and reductions in the fuel oil rate eventually cured the problem later in the day.

At 18.00 a thunderstorm caused two brief shut downs due to lightning strikes on the power lines, but in each case start-up was almost immediate.

17.6.74 (Day 18)

Trouble with cyclone drain valves dominated the day.

At 21.00 a heavy fuel oil leak was detected on the underside of the unit at several points. A possible explanation was a leak into the space between the refractory and the bottom steel casing.

18.6.74 (Day 19)

A system to inject SO_2 into the air supply to the burner was set up and tests were started to confirm the reliability of the analytical sampling systems. Several of these tests were carried out throughout the day.

At the end of the day preparations were made for a sulphation and slumped bed decoke.

19.6.74 (Day 20)

After the decoke the unit was restarted on kerosine combustion at 04.00. Several further SO_2 injection tests were carried out and it was concluded that 61% of the SO_2 injected was picked up by the flue gas sampling system. The most likely position where losses could occur was concluded to be at the sampling filter.

At 06.20 the unit was shutdown to allow the boiler to be inspected and cleaned. A large amount of material was removed.

After a false start due to a leaking fuel pump start-up on kerosine combustion was achieved at 10.30.

20.6.74 (Day 21)

The initial attempt to gasify at 04.15 was unsuccessful because trace heating on the fuel line had been switched off resulting in a build-up of pressure on the line. A successful start-up on gasification was achieved at 05.00. Initially high flue gas SO_2 readings were obtained until the sulphate levels on the stone were reduced.

Further SO_2 injection tests were carried out during the day.

21.6.74 (Day 22)

More tests on SO_2 injection were carried out during the day. This time injections into the bifurcated duct,the regenerator upper space tapping and the boiler were all tried out.

Before completion of the test run a short trial measuring the effect on performance of moving the bottom fuel injector up through the bed, effectively changing the bed depth was carried out.

INSPECTION, RUN 8

Gasifier and Regenerator Refractory

The unit was shut down and inerted with nitrogen at the end of the run without bed sulphation or carbon burn out so that the cyclone and dust deposits could be examined.

The gasifier was generally in good condition with carbon deposits on all faces. In the lower area the carbon was hard and polished where it had been in contact with the fluid bed. At the top, particularly around the cyclone entries the carbon was bonded to the refractory to form a thicker layer with a granular surface finish.

The additional lift of refractory installed prior to Run 8 showed some cracks which in general formed a continuation of the cracks which were present in the original gasifier refractory.

The refractory blocks which were inserted into the gasifier to reduce the bed area were free of cracks and in excellent condition. Carbon was deposited in the gaps between these blocks, and the gasifier wall. The head of the bolt retaining one of the blocks to the wall was sheared from the shank, probably due to distortion of the outer mild steel casing of the gasifier which could have induced very large tensile forces.

The gasifier lid refractory which had carbon deposited on the exposed faces was in good condition and free from cracks. The transfer passage to the regenerator was unobstructed, but the return line to the gasifier contained some hard agglomerated material bonded to the refractory on the rear face of the transfer section. However, it is unlikely that this obstruction was sufficient to restrict the flow of material. The underquarl was undamaged and free from the agglomerates which have been observed in earlier runs.

The regenerator bore was quite clear in the middle and upper section, but two agglomerates had formed between the distributor and the transfer passage from the gasifier. Figure F-1 shows the regenerator bore viewed from the underside after the removal of the distributor. The two agglomerates were not bonded together and this suggests that they were formed at different times, probably during the emergency shut downs which occurred during the run. The shut down control system did not cut off the total air supply to the regenerator, and there was probably enough oxygen to react locally with defluidised material thus raising its temperature and allowing formation of the sticky $CaS/CaO/CaSO_4$ eutectic.

The regenerator refractory did not show any significant deterioration in the lower lifts which have been extensively cracked from earlier test runs. The upper lift which was added for this run appeared to be in good condition. The outlet bore from the top of the regenerator was quite clean, unlike earlier runs when irregular hard fused deposits had formed in this bore.

Gasifier and Regenerator Penetrations

The thermocouples, drain tubes and pressure tappings were in good condition with light carbon and lime deposits on those areas exposed to the bed material. The ends of the angled bed pressure tapping tubes were cut in a vertical plane before installation on this run whereas in earlier runs they had been cut on a horizontal plane. This change has prevented obstructions in the regenerator bottom tapping which were always a problem in earlier runs.

The tip of the left hand fuel injector was burnt away leaving the open bore of the 18 mm tube flush with the wall. This would have given a poor fuel distribution and probably accounts for the heavy fuel oil seepage observed underneath the unit. The right hand fuel injector and vertical fuel injector in the distributor were in good condition.

The silicon carbide tube, which was installed through the refractory sleeving blocks to project towards the material transfer port was clear and undamaged.

Cyclones

Figure F-2 shows the entry ducts to the cyclones after the test run. The right hand duct had significantly less carbon deposited on one sidewall. This may have resulted from the greater quantity of fine material which entered the cyclone as indicated by the higher operating temperature in the transfer vessel which drained the right hand cyclone. The cyclone fines return system injected the fines into the right hand side of the bed immediately below this cyclone entry, and so may have resulted in a heavier fines loading on that portion of the bed and gas space. The deposits in the entries were firmly attached to the refractory and the irregular surface profile was most marked on the left hand entry wall of the left hand cyclone. The cyclone entries were very clear compared with previous operations, although the gasification period since the previous burn out was fairly short, at approximately 30 hours. This does show that the carbon burn out procedures were very effective in removing the carbon-lime deposits.

The bores of the cyclones were generally clean apart from the left hand (Figure F-3) cyclone which had a small build up of material where the entry blended with the bore. The drain of the left hand cyclone was partially obstructed at the base of the cyclone (Figure F-3) by a layer of carbon and lime. This obstruction would not have prevented the cyclone draining, although the efficiency of operation could be slightly reduced. The drain of the right hand cyclone (Figure F-4) was quite clear.

The cyclone outlet tubes both had deposits of flakey carbon and lime on their external faces (Figures F-5 and F-6). There was a small area on each tube immediately opposite the entry duct where the deposit was smooth due to the impingement of the fine material. Figures F-7 and F-8 show that these are as on the left and right hand tubes respectively. The deposited layer had fallen away when the left hand tube was removed from the unit.

Gasifier and Regenerator Distributors

The gasifier distributor was in good condition with a hard layer of lime deposited immediately below the nozzles in the defluidised zone. The stainless steel nozzles were undamaged, but 15% were totally obstructed with lime particles with a further 3% partially obstructed.

The defluidised material on the distributor was impregnated with oil (Figure F-9) around the centre injector which had been retracted to the lowest position as the last test before the shut down. In addition the lower portion of the defluidised material at the left hand side of the distributor was also impregnated with oil which had come from the damaged left hand fuel injector. The two nozzles in this area were coated with oil which had run back into the plenum from the damaged injector. There was also a considerable quantity of bed material in the plenum indicating that 5.8 mm dia. holes with this distributor design and bed particle size will permit material to fall back under some conditions.

The regenerator distributor was partially covered by the agglomerate and 7 of the 16 holes were obstructed, Figure F-10. The upper cone section on the distributor top was a modification introduced to eliminate the static bed which could form immediately above the distributor. This modification apparently did not help fluidisation and possibly contributed to the formation of the agglomerate.

Bed Material

The gasifier was shut down without sulphation and the sulphided bed was found to be free from agglomerates apart from three carbon-lime deposits shown in Figure F-11. The larger deposit was found near the centre of the bed and just below the slumped surface, and it seems probable that it had formed around the open end of the burnt fuel injector when there was bad fuel distribution. The source of the two smaller particles is unknown.

The regenerator bed was free flowing apart from the presence of the two large agglomerates. These would have adversely affected the fluidisation of the bed.

Bifurcated Duct

The new bifurcated duct necessary because of the additional height of the gasifier included two additional right angled bends to bring the hot gas back to the burner. The construction of the gas duct was the same as in previous runs, with refractory enclosed by insulation and sealed with a mild steel cladding. The refractory was in excellent condition without signs of cracking or spalling. The bore of the duct was generally coated with carbon about 3 mm thick, but at the right angled corners there were additional deposits, particularly on the inside of the bends with local thickness up to 10 mm. These additional deposits extended for lengths between 5 and 15 mms along the pipe near the curved section.

Premix Section

Figure F-12 shows the up-stream side of the premix section with a carbon layer up to 6 mm thick generally uniform about the circumference with one piece which broke away during the removal of the section. Figure F-13 shows the down-stream section with the outer air annulus through which the first stage air is admitted. Some deposits of limestone can be seen in the air annulus section where material has been thrown out of the gas stream.

Figure F-14 shows the premix section after the removal of the carbon and lime showing some local deterioration in the inner tube, and also in the outer air shroud. It is likely that this deterioration in the material comes from high temperatures associated with local carbon burning.

Figure F-15 shows the up-stream side of the burner which is joined to the premix section. Deposits of lime with some carbon can be seen on the lower portion, and there is a general deposit of carbon on the conical duct leading into the burner gas discharge orifice. Figure F-16 shows the discharge orifice with the inner annulus through which the second stage air is admitted, and the outer annulus through which the final combustion air is passed. The steelwork on the burner was generally in good condition, apart from one small hole around a weld joint, Figure F-17. The thermocouple inserted into the burner throat had burnt away, presumably during a burn out with the associated high surface temperatures.

Fig F-1 Regenerator Bore after Distributor has been Removed

Fig F-2 Gasifier Cyclone Entry Ducts

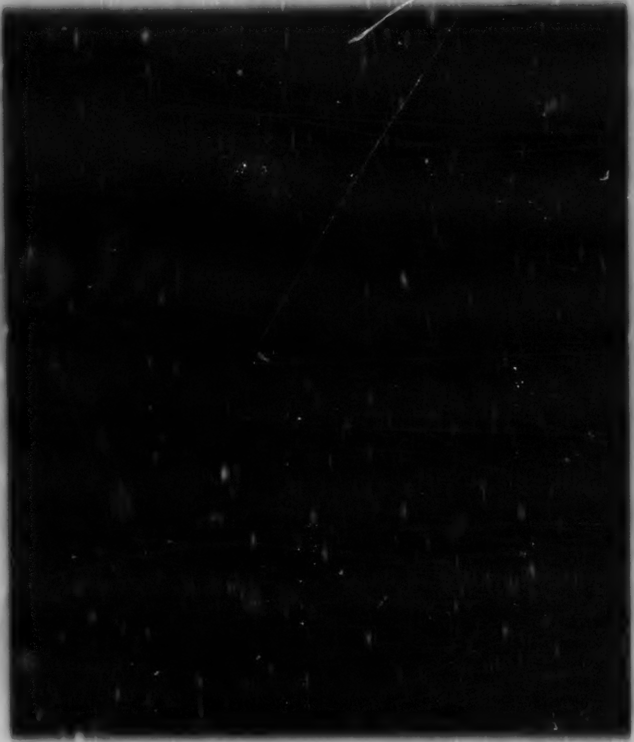

Fig F-3 View of Left Hand Cyclone

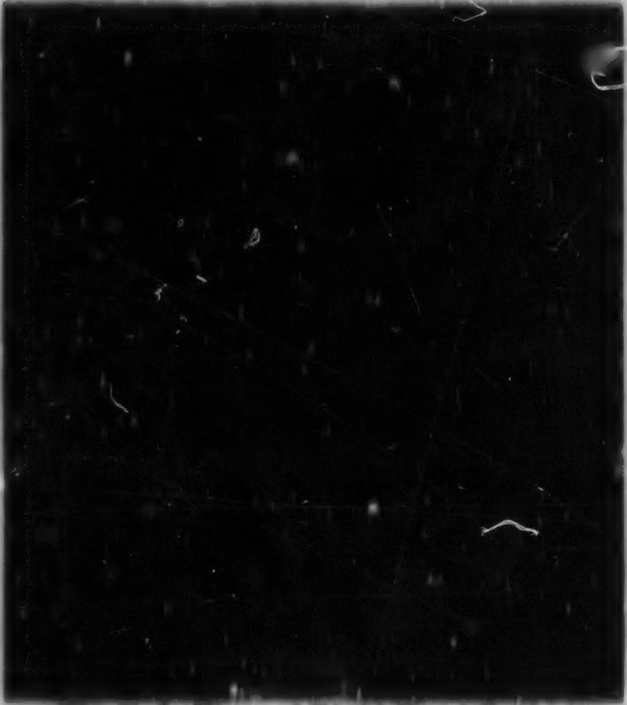

Fig F-4 View of Right Hand Cyclone

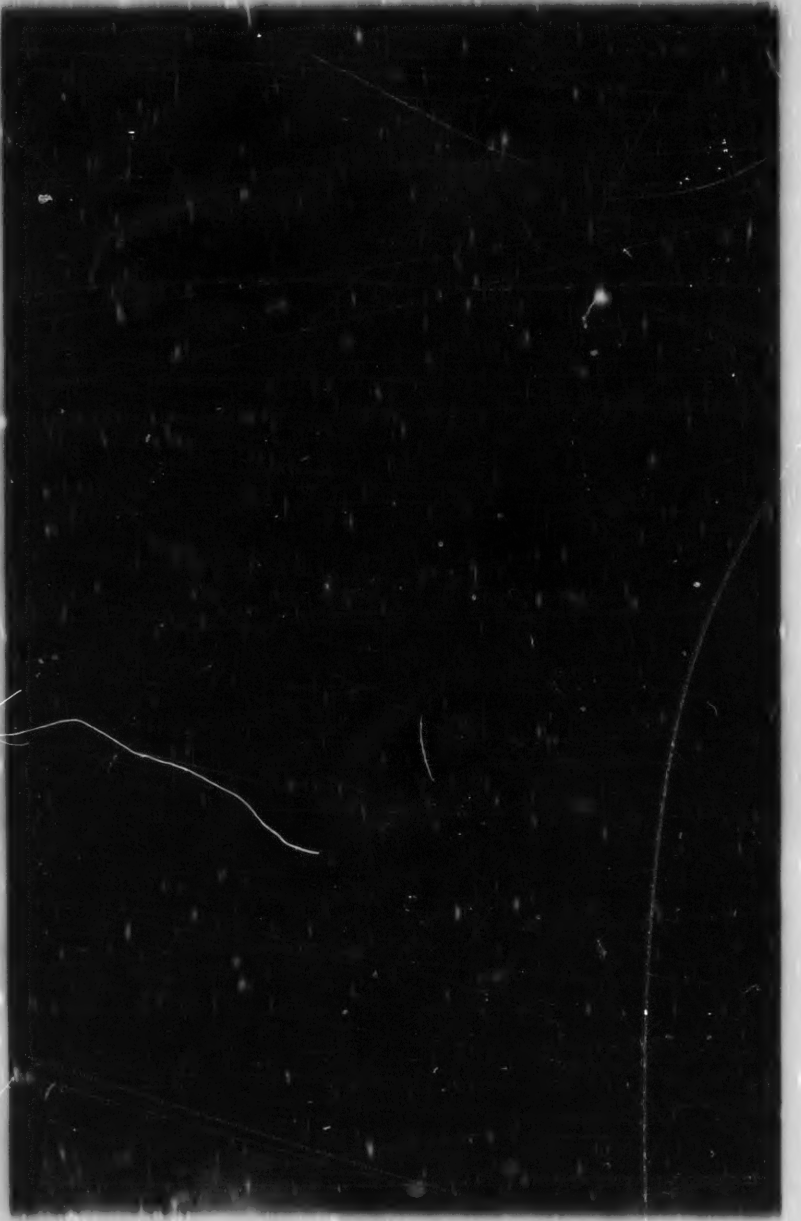

Fig F-9 Left Hand Cyclone Outlet Tubes

Fig F-6 Right Hand Cyclone Outlet Tubes

Fig F-7 Left Hand Cyclone Outlet Tube (second view)

Fig F-8 Right Hand Cyclone Outlet Tube (second view)

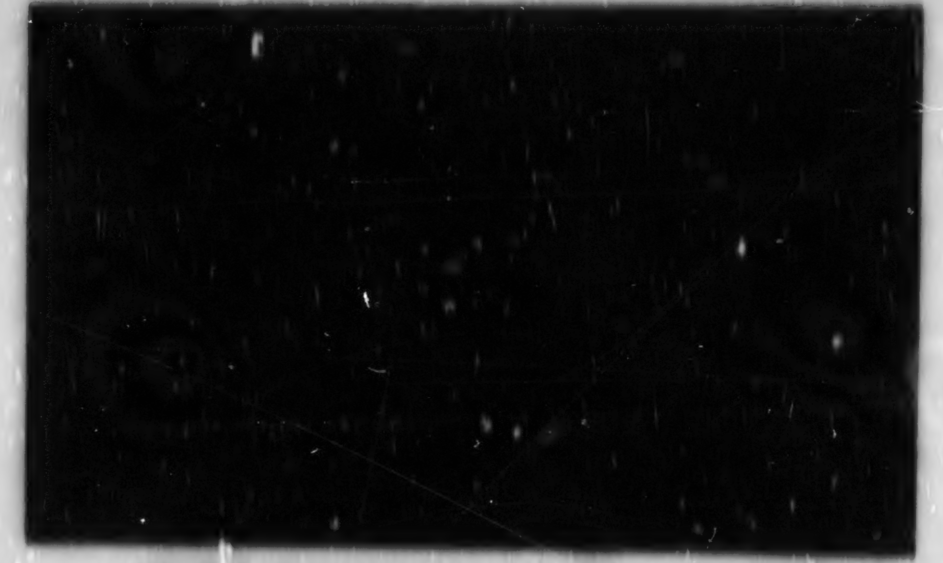

Fig F-9 Overhead View of Gasifier Distributor

Fig F-10 View of Regenerator Distributor

Fig F-11 Carbon/Lime Deposits Found in Gasifier

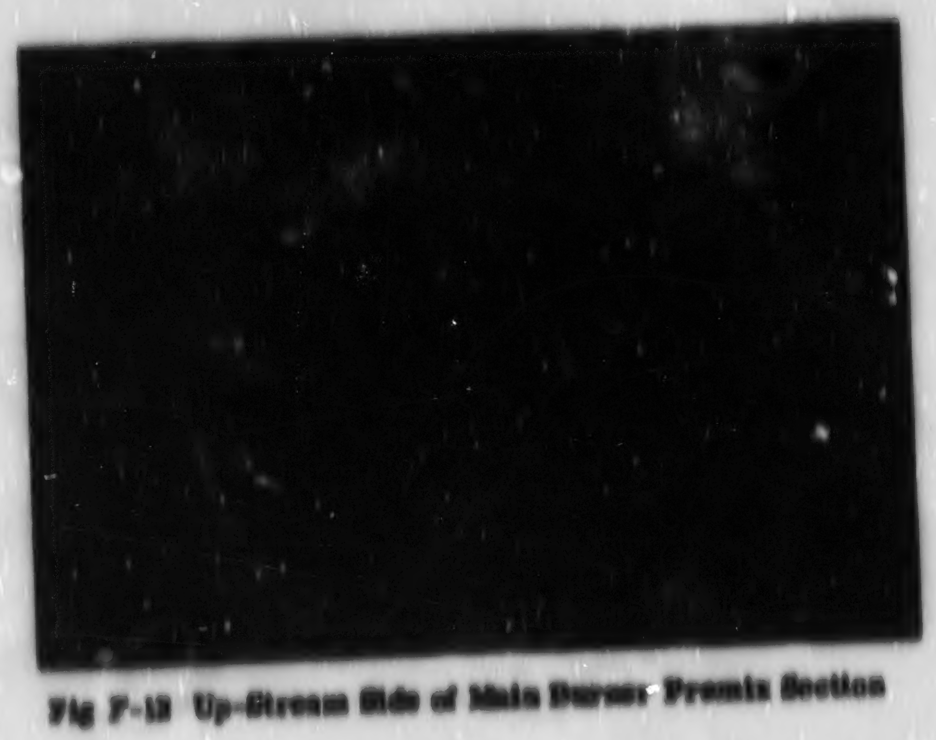

Fig F-12 Up-Stream Side of Main Burner Premix Section

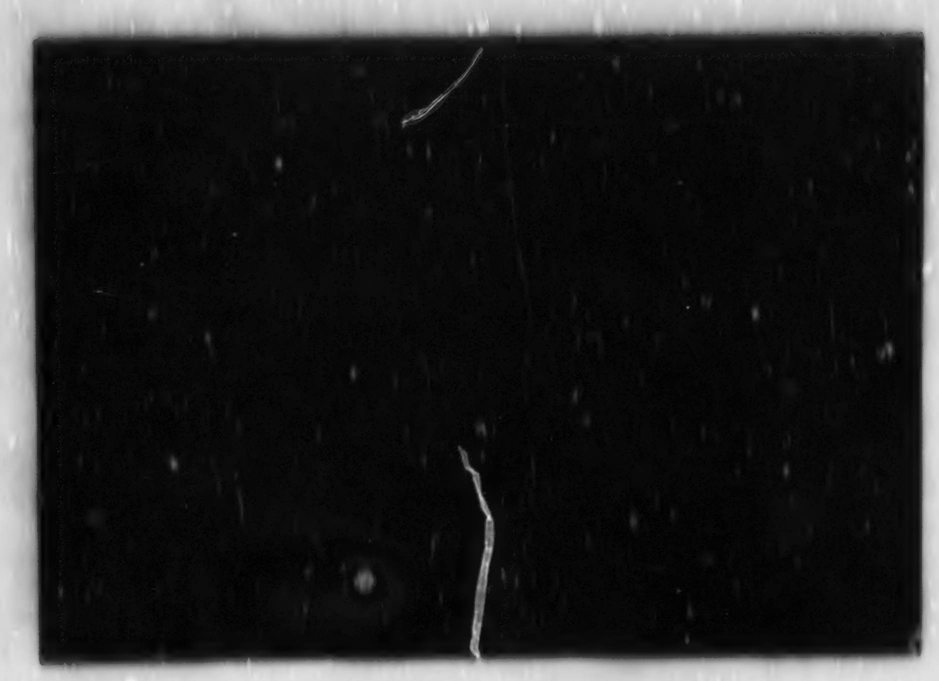

Fig F-13 Main Burner Downstream Section

Fig F-14 Main Burner Premix Section after Removal of Carbon and Lime

Fig F-15 Up-Stream Side of Main Burner (joined to the premix section)

Fig F-16 Main Burner Discharge Orifice

Fig F-17 Main Burner Steelwork (showing small hole in weld joint)

APPENDIX E: TABLE 1.
RUN 8: TEMPERATURES AND FEED RATES PAGE 1 OF 12

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
1.0330	850.	970.	56.	142.8	9.1
1.0430	858.	1032.	56.	142.8	28.4
1.0530	870.	1040.	56.	142.1	25.9
1.0630	882.	1050.	55.	142.8	24.5
1.0730	891.	1050.	56.	142.8	24.8
1.0830	900.	1048.	56.	141.6	22.7
1.0930	891.	1052.	56.	142.8	22.7
1.1030	877.	998.	56.	142.8	29.8
1.1130	885.	1028.	56.	142.8	32.2
1.1230	878.	1058.	56.	144.8	29.8
1.1330	886.	1058.	56.	144.8	36.7
1.1430	890.	1059.	56.	142.8	28.6
1.1530	891.	1053.	56.	141.6	28.1
1.1630	888.	1048.	56.	143.6	34.9
1.1730	874.	1051.	56.	136.2	35.6
1.1830	872.	1058.	56.	145.7	39.8
1.1930	[illegible]	1055.	56.	141.4	41.7
1.2030	[illegible]	1061.	56.	142.4	29.8
1.2130	878.	1062.	56.	141.6	29.8
1.2230	888.	1062.	56.	148.8	24.5
1.2330	883.	1062.	55.	148.8	24.8
2.0030	887.	1060.	54.	144.8	23.1
2.0130	888.	1060.	54.	148.8	26.3
2.0230	878.	1058.	53.	135.4	27.2
2.0330	888.	1058.	53.	131.3	34.5
2.0430	859.	1058.	53.	128.8	43.5
2.0530	872.	1058.	53.	133.8	37.9
2.0630	872.	1058.	53.	133.3	29.5
2.0730	874.	1058.	52.	134.2	27.2
2.0830	898.	1059.	49.	135.8	22.7
2.0930	888.	1059.	49.	137.8	26.8
2.1030	879.	1059.	49.	137.9	24.9
2.1130	864.	1058.	[illegible]	137.8	31.8
2.1230	898.	1055.	49.	137.9	28.8
2.1330	900.	1058.	49.	139.5	18.1
2.1430	886.	1059.	50.	139.1	28.1
2.1530	877.	1051.	53.	137.8	38.1
2.1630	888.	1031.	52.	132.5	29.8
2.1730	889.	1058.	54.	137.5	28.6
2.1830	884.	1059.	54.	137.5	24.9

APPENDIX 21 TABLE 1.
RUN 81 TEMPERATURES AND FEED RATES PAGE 2 OF 12

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	 REGEN.	 RECYCLE	FEED RATE KG/HR OIL	 STONE
2.1930	880.	1850.	54.	137.8	24.0
2.2030	870.	1842.	61.	137.5	14.5
2.2130	882.	1858.	61.	137.8	17.2
2.2230	880.	1856.	57.	136.2	51.3
2.2330	888.	1858.	59.	132.1	54.8
3.0030	897.	1863.	57.	142.0	23.6
3.0130	902.	1856.	57.	151.0	13.2
3.0230	912.	1858.	61.	158.4	10.5
3.0330	888.	1858.	62.	163.8	10.5
3.0430	880.	1861.	62.	168.7	15.0
3.0530	890.	1858.	63.	168.3	14.1
3.0630	885.	1857.	64.	168.3	14.1
3.0730	888.	1858.	64.	168.7	9.5
3.0830	885.	1858.	65.	160.7	8.3
3.0930	885.	1861.	65.	160.1	10.4
3.1030	886.	1858.	62.	154.3	11.8
3.1130	872.	1859.	61.	145.7	17.7
3.1230	882.	1859.	61.	145.0	11.3
3.1330	876.	1858.	60.	145.7	22.2
3.1430	877.	1859.	60.	140.8	28.7
3.1530	878.	1859.	60.	142.4	27.2
3.1630	880.	1858.	59.	140.7	22.2
3.1730	891.	1858.	59.	138.3	24.2
3.1830	893.	1858.	59.	150.8	27.2
3.1930	870.	1858.	61.	143.5	36.3
3.2030	872.	1858.	61.	141.6	33.8
3.2130	888.	1858.	61.	140.1	37.2
3.2230	888.	1858.	61.	140.8	38.4
3.2330	888.	1859.	60.	141.6	37.6
4.0030	886.	1857.	55.	144.0	0.8
4.0130	891.	1857.	55.	144.8	20.5
4.0230	878.	1855.	56.	145.3	24.5
4.0330	871.	1855.	56.	145.3	30.0
4.0430	882.	1856.	54.	143.6	40.4
4.0530	888.	1856.	55.	142.4	40.8
4.0630	886.	1855.	54.	142.8	16.3
4.0730	875.	1856.	59.	144.5	11.8
4.0830	873.	1858.	57.	144.1	18.1
4.0930	882.	1858.	57.	142.2	23.1
4.1030	888.	1858.	57.	140.8	0.6

APPENDIX F: TABLE 1.
RUN 81 TEMPERATURES AND FEED RATES PAGE 3 OF 12

DAY.HOUR	TEMPERATURE, DEG. C.			FEED RATE KG/HR	
	GASIFIER	REGEN.	RECYCLE	OIL	STONE
4.1130	898.	1050.	57.	142.8	7.7
4.1230	902.	1060.	60.	142.3	6.8
4.1330	892.	1060.	60.	143.8	11.3
4.1430	896.	1060.	60.	145.3	14.5
4.1530	895.	1058.	60.	142.4	14.1
4.1630	900.	1045.	60.	142.8	12.7
4.1730	895.	1050.	60.	140.0	14.1
4.1830	896.	1050.	60.	145.3	17.7
4.1930	898.	1048.	60.	142.8	15.9
4.2030	892.	1048.	60.	143.7	14.1
4.2130	890.	1048.	58.	142.4	15.9
4.2230	895.	1048.	58.	143.2	16.8
4.2330	893.	1049.	58.	143.2	11.8
5.0030	894.	1051.	58.	143.0	12.7
5.0130	892.	1052.	58.	143.9	14.5
5.0230	892.	1053.	56.	143.6	13.6
5.0330	896.	1051.	55.	142.4	10.9
5.0430	893.	1052.	53.	143.6	12.7
5.0530	898.	1050.	54.	142.8	14.5
5.0630	891.	1055.	54.	143.6	13.6
5.0730	896.	1052.	55.	143.2	10.8
5.0830	893.	1055.	54.	143.6	11.3
5.0930		MISSED DATA READING			
5.1030		MISSED DATA READING			
5.1130	900.	1054.	64.	144.9	5.8
5.1230	908.	1050.	70.	140.1	11.8
5.1330	898.	1054.	70.	144.9	9.5
5.1430	900.	1052.	70.	144.5	8.2
5.1530	898.	1045.	70.	144.5	6.8
5.1630	878.	1050.	70.	144.5	10.4
5.1730	880.	1050.	70.	144.5	11.8
5.1830	886.	1052.	68.	142.8	10.4
5.1930	896.	1055.	70.	134.2	8.2
5.2030	928.	1055.	62.	133.8	6.8
5.2130	921.	1052.	65.	132.9	6.4
5.2230	913.	1050.	60.	133.8	9.5
5.2330	909.	1048.	59.	135.3	11.3
6.0030	908.	1051.	59.	133.8	10.4
6.0130	906.	1049.	59.	132.9	10.9
6.0230	918.	1049.	58.	133.3	5.9

APPENDIX F: TABLE 1.
RUN 8: TEMPERATURES AND FEED RATES PAGE 4 OF 12

DAY.HOUR	TEMPERATURE, DEG. C.			FEED RATE KG/HR	
	GASIFIER	REGEN.	RECYCLE	OIL	STONE
6.0330	986.	1048.	59.	133.3	8.2
6.0430	882.	1051.	59.	133.3	20.0
6.0530	884.	1050.	58.	133.8	5.9
6.0630	887.	1052.	63.	133.8	11.8
6.0730	888.	1052.	60.	133.8	11.3
6.0830	893.	1048.	61.	132.9	12.7
6.0930	889.	1048.	62.	133.3	14.1
6.1030	892.	1058.	62.	134.2	4.5
6.1130	889.	1058.	62.	135.8	11.3
6.1230	888.	1058.	62.	135.8	11.8
6.1330	882.	1058.	60.	130.1	10.9
6.1430	885.	1060.	60.	130.2	9.1
6.1530	898.	1060.	62.	134.2	7.7
6.1630	908.	1060.	62.	133.3	10.9
6.1730	904.	1060.	62.	134.2	12.7
6.1830	894.	1060.	62.	135.8	5.8
6.1930	892.	1058.	62.	133.8	8.6
6.2030	883.	1062.	62.	133.8	10.9
6.2130	888.	1061.	62.	134.2	10.8
6.2230	876.	1059.	61.	134.6	10.6
6.2330	872.	1058.	60.	134.2	15.6
7.0030	876.	1056.	58.	133.8	15.4
7.0130	886.	1058.	59.	134.2	13.3
7.0230	883.	1056.	59.	134.6	16.3
7.0330	882.	1058.	55.	134.2	15.9
7.0430	879.	1057.	53.	133.8	13.6
7.0530	886.	1060.	53.	134.2	10.9
7.0630	888.	1060.	53.	134.6	10.9
7.0730	892.	1058.	52.	133.8	10.9
7.0830	900.	1061.	53.	133.8	11.3
7.0930	911.	1059.	57.	134.2	12.7
7.1030	878.	1060.	62.	134.2	12.2
7.1130	878.	1060.	62.	134.2	15.4
7.1230	878.	1060.	62.	131.7	9.5
7.1330	891.	1058.	62.	136.6	7.7
7.1430	881.	1060.	62.	134.2	7.7
7.1530	873.	1060.	63.	133.8	10.9
7.1630	878.	1060.	66.	133.8	11.3
7.1730	886.	1059.	67.	133.8	13.6
7.1830	890.	1060.	63.	133.8	15.4

APPENDIX B: TABLE 1.
RUN H1 TEMPERATURES AND FEED RATES PAGE 5 OF 12

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	 REGEN.	 RECYCLE	FEED RATE KG/HR OIL	 STONE
7.1930	886.	1060.	63.	134.2	14.1
7.2030	890.	1060.	63.	133.8	11.8
7.2130	885.	1060.	63.	134.2	12.7
7.2230	881.	1058.	63.	133.8	8.6
7.2330	887.	1059.	63.	135.8	16.4
8.0030	889.	1058.	63.	133.8	12.7
8.0130	888.	1059.	63.	131.3	11.8
8.0230	885.	1059.	63.	130.3	12.2
8.0330	883.	1061.	63.	131.7	11.8
8.0430	884.	1061.	63.	134.2	12.7
8.0530	890.	1059.	63.	134.2	12.7
8.0630	883.	1057.	63.	135.8	11.3
8.0730	886.	1057.	63.	132.5	9.5
8.0830	885.	1058.	64.	133.8	9.5
8.0930	877.	1058.	66.	134.2	8.9
8.1030	886.	1056.	68.	134.2	8.6
8.1130	892.	1058.	68.	133.3	8.6
8.1230	888.	1058.	68.	134.0	8.8
8.1330	892.	1058.	68.	133.8	8.7
8.1430	898.	1060.	68.	133.8	7.7
8.1530	890.	1060.	68.	133.8	11.8
8.1630	890.	1060.	68.	133.8	11.3
8.1730	888.	1060.	68.	134.2	10.8
8.1830	890.	1060.	68.	133.8	9.8
8.1930	886.	1060.	70.	133.8	9.8
8.2030	888.	1059.	71.	133.8	11.9
8.2130	885.	1059.	70.	133.8	10.9
8.2230	889.	1058.	70.	133.8	11.8
8.2330	891.	1059.	69.	133.8	9.1
9.0030	891.	1058.	69.	133.8	7.7
9.0130	889.	1056.	68.	133.3	7.7
9.0230	888.	1058.	68.	133.8	7.7
9.0330	888.	1059.	69.	133.8	4.1
9.0430	878.	1058.	70.	133.8	15.8
9.0530	882.	1056.	71.	133.8	18.9
9.0630	889.	1056.	71.	133.8	18.4
9.0730	888.	1058.	70.	133.8	18.4
9.0830	871.	1058.	71.	133.8	14.5
9.0930	871.	1058.	70.	133.8	5.4
9.1030	886.	1056.	70.	133.8	8.6

APPENDIX 2: TABLE 1.
RUN 61 TEMPERATURES AND FEED RATES PAGE 6 OF 17

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	 REGEN.	 RECYCLE	FEED RATE KG/HR OIL	 STONE
9.1130	892.	1050.	71.	134.2	8.7
9.1230	887.	1058.	72.	133.8	6.4
9.1330	899.	1055.	71.	134.2	11.3
9.1430	889.	1050.	71.	134.6	10.8
9.1530	885.	1058.	71.	133.3	15.4
9.1630	898.	1060.	70.	133.8	13.0
9.1730	889.	1058.	70.	133.8	9.8
9.1830	879.	1057.	71.	134.2	12.2
9.1930	888.	1056.	71.	133.8	15.8
9.2030	882.	1058.	72.	124.2	11.3
9.2130	870.	1058.	71.	134.2	9.1
9.2230	888.	1057.	69.	133.3	9.1

SHUT DOWN AT 9.2230 FOR 23 HOURS

DAY.HOUR	GASIFIER	REGEN.	RECYCLE	OIL	STONE
10.2230	888.	990.	62.	144.8	15.9
10.2330	888.	1030.	62.	144.8	13.2
11.0030	888.	1040.	62.	150.6	14.5
11.0130	888.	1032.	62.	151.9	10.1
11.0230	885.	1051.	62.	153.1	10.6
11.0330	887.	1045.	62.	153.5	11.0
11.0430	908.	1054.	62.	153.9	9.1
11.0530	894.	1052.	62.	154.7	8.6
11.0630	892.	1054.	62.	155.6	10.4
11.0730	892.	1054.	62.	116.9	10.4

SHUT DOWN AT 11.0730 FOR 19 HOURS

DAY.HOUR	GASIFIER	REGEN.	RECYCLE	OIL	STONE
12.0330	908.	930.	63.	127.1	10.8
12.0430	920.	950.	65.	128.6	11.8
12.0530	908.	970.	63.	128.9	15.8
12.0630	908.	1000.	65.	131.1	11.8
12.0730	910.	1000.	65.	135.7	8.2
12.0830	912.	1010.	65.	137.3	8.6
12.0930	912.	1010.	67.	137.8	12.2
12.1030	908.	1032.	68.	137.6	13.2
12.1130	888.	1020.	68.	130.8	30.4
12.1230	898.	1034.	40.	137.9	16.3

APPENDIX F1 TABLE 1.
RUN 8: TEMPERATURES AND FEED RATES PAGE 7 OF 12

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
12.1330	898.	1034.	49.	136.2	14.1
12.1430	898.	990.	59.	137.6	22.2
12.1530	865.	995.	55.	139.1	24.6
12.1630	875.	1030.	60.	137.3	26.9
12.1730	878.	1030.	55.	160.1	23.0
12.1830	882.	1040.	65.	157.6	21.3
12.1930	871.	1041.	62.	149.7	20.8
12.2030	871.	1047.	57.	149.4	28.0
12.2130	875.	1030.	52.	149.4	25.4
12.2230	888.	1033.	52.	149.8	18.6
12.2330	888.	1033.	52.	149.0	14.1
13.0030	895.	1045.	58.	152.7	14.1
13.0130	895.	1040.	58.	149.4	18.6
13.0230	874.	1038.	58.	149.8	28.4
13.0330	888.	1040.	58.	144.8	15.4
13.0430	875.	1033.	58.	161.3	17.7
13.0530	878.	1038.	58.	164.4	17.7
13.0630	867.	1038.	58.	157.7	17.7
13.0730	878.	1035.	46.	161.6	16.8
13.0830	872.	1038.	45.	168.9	13.2
13.0930	876.	1025.	44.	162.8	8.2
13.1030	878.	1014.	45.	163.0	20.4
13.1130	898.	1038.	45.	168.2	24.9
13.1230	898.	1044.	45.	162.8	22.7
13.1330	889.	1050.	45.	162.8	24.9
13.1430	888.	1053.	40.	162.8	14.5
13.1530	898.	1058.	47.	162.3	20.9
13.1630	888.	1052.	48.	161.2	22.2
13.1730	888.	1052.	48.	162.8	23.6
13.1830	882.	1052.	40.	162.7	21.1
13.1930	898.	1051.	42.	162.0	19.5
13.2030	875.	1049.	48.	161.7	20.3
13.2130	898.	1058.	48.	160.6	20.9
13.2230	892.	1054.	38.	161.7	22.7
13.2330	891.	1052.	38.	162.8	23.1
14.0030	879.	1052.	38.	177.7	20.9
14.0130	883.	1052.	33.	170.3	20.8
14.0230	884.	1050.	33.	169.5	21.3
14.0330	882.	1052.	32.	167.9	20.8
14.0430	888.	1054.	32.	166.1	21.8

APPENDIX F: TABLE 1. PAGE 8 OF 12

RUN 11 TEMPERATURES AND FEED RATES

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
14.0530	890.	1852.	32.	169.1	20.0
14.0630	889.	1852.	32.	169.9	19.1
14.0730	889.	1850.	32.	168.7	19.5
14.0830	888.	1852.	32.	168.3	18.6
14.0930	886.	1851.	30.	168.3	17.2
14.1030	888.	1851.	31.	168.7	19.5
14.1130	879.	1852.	31.	167.9	24.0
14.1230	879.	1852.	31.	168.7	21.0
14.1330	888.	1851.	31.	167.8	23.1
14.1430	881.	1852.	31.	166.8	18.1
14.1530	888.	1852.	31.	166.4	23.1
14.1630	888.	1852.	31.	167.5	24.9
14.1730	879.	1852.	31.	167.9	23.6
14.1830	889.	1852.	31.	167.5	22.7
14.1930	898.	1852.	32.	168.3	20.9
14.2030	891.	1851.	32.	167.9	23.1
14.2130	894.	1852.	32.	167.9	23.6
14.2230	895.	1852.	32.	167.2	24.9
14.2330	892.	1852.	32.	169.2	20.9
15.0030	885.	1856.	32.	169.6	20.9
15.0130	886.	1854.	32.	170.8	26.8
15.0230	888.	1852.	32.	170.8	19.9
15.0330	895.	1852.	32.	169.6	27.5
15.0430	886.	1853.	31.	169.3	25.6
15.0530	887.	1853.	31.	170.8	24.8
15.0630	886.	1854.	31.	170.4	19.9
15.0730	892.	1853.	31.	169.3	23.1
15.0830	888.	1853.	31.	169.6	21.8
15.0930	889.	1851.	31.	169.2	14.5
15.1030	882.	1850.	29.	170.8	20.9
15.1130	878.	1850.	29.	168.8	19.1
15.1230	879.	1852.	29.	168.8	20.9
15.1330	881.	1849.	28.	169.2	20.9
15.1430	885.	1851.	30.	168.8	17.7
15.1530	873.	1851.	31.	168.8	21.3
15.1630	872.	1850.	31.	164.1	24.0
15.1730	872.	1853.	31.	162.2	27.7
15.1830	875.	1854.	32.	161.8	21.8
15.1930	878.	1859.	32.	161.4	22.2
15.2030	891.	1859.	32.	161.0	26.8

APPENDIX B: TABLE 1.
RUN 8: TEMPERATURES AND FEED RATES PAGE 9 OF 17

DAY.HOUR	TEMPERATURE, DEG. C.			FEED RATE KG/HR	
	GASIFIER	REGEN.	RECYCLE	OIL	STONE
15.2130	893.	1860.	33.	161.4	20.9
15.2230	898.	1859.	33.	160.6	22.7
15.2330	898.	1858.	33.	161.4	17.8
16.0030	900.	1855.	33.	161.8	15.9
16.0130	894.	1853.	33.	162.6	20.8
16.0230	886.	1852.	33.	167.2	24.0
16.0330	879.	1855.	34.	169.7	20.3
16.0430	884.	1852.	34.	163.7	20.4
16.0530	888.	1855.	33.	178.3	22.7
16.0630	898.	1854.	32.	178.3	19.5
16.0730	898.	1854.	31.	180.8	16.8
16.0830	892.	1852.	30.	166.8	19.5
16.0930	917.	1852.	45.	159.2	13.0
16.1030	881.	1848.	35.	157.3	12.7
16.1130	888.	1850.	62.	157.3	15.4
16.1230	891.	1850.	65.	165.8	20.0
16.1330	898.	1858.	63.	167.4	19.1
16.1430	898.	1855.	52.	164.1	20.9
16.1530	908.	1856.	48.	165.4	18.6
16.1630	922.	1862.	45.	114.3	17.8
16.1730	919.	1858.	44.	141.5	9.1
16.1830	923.	1855.	44.	146.8	14.1
16.1930	928.	1845.	44.	151.4	18.6
16.2030	915.	1848.	40.	158.4	16.8
16.2130	911.	1858.	39.	164.5	14.5
16.2230	895.	1858.	37.	168.8	16.8
16.2330	885.	1858.	36.	158.8	27.2
17.0030	878.	1841.	32.	156.7	24.8
17.0130	879.	1858.	33.	157.1	27.7
17.0230	881.	1848.	32.	158.8	21.3
17.0330	885.	1844.	32.	157.1	25.9
17.0430	891.	1842.	32.	157.5	16.8
17.0530	889.	1843.	32.	157.2	19.1
17.0630	892.	1848.	31.	157.6	20.8
17.0730	898.	1839.	30.	158.1	14.1
17.0830	882.	1843.	50.	156.8	16.8
17.0930	871.	1858.	65.	149.8	20.4
17.1030	902.	1843.	65.	142.4	16.3
17.1130	912.	1860.	68.	140.4	16.3
17.1230	899.	1866.	68.	135.8	17.7

APPENDIX D: TABLE 1.
RUN 21 TEMPERATURES AND FEED RATES PAGE 18 OF 19

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
17.1330	898.	1840.	48.	141.2	23.6
17.1430	898.	1873.	58.	151.1	18.1
17.1530	918.	1868.	58.	149.8	17.2
17.1630	908.	1858.	55.	148.2	23.1
17.1730	908.	1868.	48.	147.8	8.2
17.1830	MISSED DATA READING				
17.1930	MISSED DATA READING				
17.2030	912.	1842.	35.	149.8	13.6
17.2130	899.	1852.	35.	155.8	19.5
17.2230	895.	1858.	36.	147.1	15.8
17.2330	891.	1863.	36.	148.1	26.9
18.0030	898.	1852.	37.	148.1	19.1
18.0130	894.	1859.	36.	148.6	16.3
18.0230	891.	1854.	33.	144.3	20.8
18.0330	892.	1856.	31.	144.7	15.8
18.0430	892.	1858.	31.	143.8	14.5
18.0530	895.	1852.	32.	141.4	20.3
18.0630	897.	1849.	31.	139.7	13.2
18.0730	893.	1852.	32.	138.9	17.2
18.0830	899.	1855.	33.	139.6	21.8
18.0930	904.	1858.	33.	132.6	18.9
18.1030	906.	1858.	34.	143.3	16.3
18.1130	894.	1855.	35.	145.3	17.2
18.1230	899.	1868.	35.	145.3	21.8
18.1330	903.	1862.	35.	137.1	16.8
18.1430	912.	1862.	35.	135.8	18.1
18.1530	920.	1852.	35.	135.9	15.8
18.1630	925.	1862.	40.	139.6	15.8
18.1730	918.	1859.	35.	145.3	18.6
18.1830	930.	1861.	35.	144.5	19.5
18.1930	912.	1848.	40.	142.8	20.4
18.2030	918.	1868.	35.	141.6	24.9
18.2130	899.	1868.	41.	139.6	24.5
18.2230	897.	1856.	41.	139.6	23.6
18.2330	897.	1855.	58.	148.8	28.4
19.0030	898.	1858.	31.	148.4	24.9
19.0130	911.	1855.	31.	148.4	18.1
19.0230	888.	1849.	28.	139.6	25.9
19.0330	889.	1839.	29.	149.4	20.3
19.0430	874.	1858.	29.	148.8	31.8

APPENDIX F: TABLE 1.
RUN 8: TEMPERATURES AND FEED RATES

PAGE 11 OF 12

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
19.0530	898.	1848.	30.	137.1	20.8
19.0630	899.	1857.	30.	135.5	20.4
19.0730	898.	1854.	31.	136.3	20.9
19.0830	894.	1855.	31.	135.9	16.8
19.0930	897.	1855.	30.	141.2	24.5
19.1030	908.	1856.	29.	134.2	24.0
19.1130	908.	1855.	30.	133.8	20.3
19.1230	909.	1852.	30.	134.0	25.0
19.1330	910.	1855.	30.	135.5	13.0
19.1430	898.	1850.	30.	135.8	10.0
19.1530	908.	1852.	30.	135.8	10.8
19.1630	908.	1852.	30.	135.5	8.2
19.1730	928.	1858.	30.	133.8	7.7

SHUT DOWN AT 19.1730 FOR 36 HOURS

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
21.0630	910.	1865.	29.	151.9	18.6
21.0730	898.	1842.	29.	152.7	16.9
21.0830	901.	1859.	29.	150.2	18.4
21.0930	908.	1860.	30.	155.6	9.5
21.1030	906.	1860.	30.	153.5	10.9
21.1130	901.	1860.	30.	153.1	15.9
21.1230	909.	1858.	31.	153.1	13.6
21.1330	910.	1860.	32.	152.7	9.5
21.1430	911.	1858.	34.	153.1	9.5
21.1530	918.	1858.	36.	153.5	12.2
21.1630	914.	1859.	36.	152.7	13.6
21.1730	918.	1859.	36.	153.5	13.6
21.1830	917.	1859.	35.	153.1	12.8
21.1930	915.	1858.	36.	153.1	15.4
21.2030	938.	1856.	36.	140.9	15.9
21.2130	937.	1848.	36.	144.8	11.3
21.2230	932.	1861.	36.	148.2	11.8
21.2330	925.	1861.	36.	152.7	13.6
22.0030	922.	1865.	36.	152.7	18.6
22.0130	912.	1862.	36.	152.9	18.6
22.0230	911.	1862.	35.	157.3	16.3
22.0330	914.	1862.	35.	158.0	15.4
22.0430	918.	1868.	34.	158.0	12.7

APPENDIX E: TABLE 1.
RUN 8: TEMPERATURES AND FEED RATES PAGE 12 OF 12

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
22.0530	916.	1064.	34.	159.1	12.2
22.0630	912.	1061.	34.	159.3	15.6
22.0730	911.	1059.	33.	159.3	14.1
22.0830	912.	1066.	33.	158.5	16.9
22.0930	913.	1068.	33.	158.5	7.7
22.1030	903.	1071.	32.	159.3	13.0
22.1130	895.	1059.	32.	158.6	17.2
22.1230	889.	1060.	33.	158.5	16.3
22.1330	890.	1061.	32.	158.9	15.4
22.1430	902.	1062.	6.	158.5	15.9
22.1530	MISSED DATA READING				
22.1630	911.	1062.	33.	158.9	11.8

APPENDIX B TABLE II.

RUN 81 GAS FLOW RATES PAGE 1 OF 12

	G A S	R A T E S	M3/HR			REGEN. VELOCITY
	GASIFIER		PILOT	REGENERATOR		
DAY.HOUR	AIR	FLUE GAS	PROPANE	AIR	NITROGEN	M/SEC
1.0330	290.	87.	4.6	29.8	1.7	1.37
1.0430	316.	87.	4.6	30.3	1.8	1.46
1.0530	333.	57.	4.7	24.4	2.1	1.21
1.0630	342.	57.	4.7	25.6	1.5	1.25
1.0730	351.	57.	4.7	31.3	1.7	1.53
1.0830	365.	57.	4.7	30.6	1.7	1.40
1.0930	377.	57.	4.6	28.4	2.1	1.42
1.1030	386.	57.	4.6	31.8	1.5	1.46
1.1130	391.	57.	4.6	26.8	1.8	1.30
1.1230	391.	57.	4.6	26.4	1.8	1.20
1.1330	417.	72.	4.6	31.9	1.8	1.57
1.1430	416.	71.	4.6	31.9	1.5	1.54
1.1530	416.	60.	4.7	32.8	1.6	1.60
1.1630	416.	61.	4.7	30.8	1.4	1.50
1.1730	416.	61.	4.7	28.3	1.7	1.39
1.1830	416.	59.	4.7	28.8	1.7	1.20
1.1930	416.	46.	4.7	31.0	1.6	1.53
1.2030	418.	44.	4.7	29.0	1.1	1.46
1.2130	418.	46.	4.7	29.1	1.5	1.41
1.2230	419.	47.	4.7	28.6	1.6	1.40
1.2330	419.	49.	4.7	28.6	1.5	1.40
2.0030	402.	39.	4.7	29.0	1.5	1.42
2.0130	418.	58.	4.7	27.0	1.6	1.37
2.0230	376.	42.	4.7	33.6	1.6	1.63
2.0330	359.	46.	4.7	34.8	1.7	1.60
2.0430	359.	47.	4.7	36.8	1.6	1.56
2.0530	376.	50.	4.7	32.0	1.5	1.56
2.0630	376.	37.	4.7	32.7	1.7	1.60
2.0730	393.	37.	4.7	30.7	1.6	1.58
2.0830	393.	41.	4.7	30.8	1.5	1.50
2.0930	397.	41.	4.6	34.8	1.3	1.60
2.1030	392.	34.	4.6	30.1	1.6	1.47
2.1130	393.	40.	4.6	30.3	1.7	1.44
2.1230	400.	52.	4.7	28.9	1.4	1.40
2.1330	408.	40.	4.7	31.7	1.5	1.54
2.1430	417.	43.	4.9	32.9	1.4	1.50
2.1530	409.	47.	4.9	31.9	1.5	1.54
2.1630	408.	57.	4.9	32.1	1.5	1.53
2.1730	413.	57.	4.9	30.8	1.4	1.46
2.1830	404.	57.	4.9	34.6	1.6	1.60

APPENDIX B, TABLE 11.
RUN 87 GAS FLOW RATES

PAGE 2 OF 12

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
2.1930	401.	57.	4.9	31.8	1.6	1.55
2.2030	375.	127.	4.9	30.8	1.5	1.48
2.2130	392.	107.	4.9	29.7	1.2	1.43
2.2230	427.	87.	4.9	28.2	1.6	1.38
2.2330	418.	88.	4.9	28.6	1.5	1.38
3.0030	429.	88.	4.9	30.7	1.5	1.48
3.0130	428.	88.	4.9	31.5	1.5	1.52
3.0230	427.	88.	4.9	30.9	1.8	1.58
3.0330	401.	106.	4.9	29.3	1.5	1.41
3.0430	401.	186.	4.9	29.1	1.3	1.38
3.0530	401.	186.	4.9	29.1	1.5	1.40
3.0630	401.	286.	4.9	28.0	1.5	1.36
3.0730	401.	225.	4.9	31.3	1.5	1.58
3.0830	453.	225.	4.9	32.2	1.6	1.54
3.0930	428.	286.	4.9	33.7	1.8	1.62
3.1030	325.	146.	4.9	34.8	2.0	1.66
3.1130	333.	157.	4.9	36.6	2.8	1.58
3.1230	342.	137.	4.9	33.1	1.9	1.61
3.1330	359.	117.	4.9	31.9	2.0	1.56
3.1430	376.	188.	4.9	31.3	1.9	1.53
3.1530	376.	188.	4.9	28.9	2.0	1.43
3.1630	384.	188.	4.9	29.8	1.6	1.41
3.1730	392.	98.	4.9	31.6	1.8	1.54
3.1830	393.	98.	4.9	30.3	1.8	1.47
3.1930	393.	98.	4.9	29.8	1.7	1.45
3.2030	393.	88.	4.9	30.9	1.7	1.51
3.2130	393.	88.	4.9	30.6	1.6	1.49
3.2230	384.	88.	4.9	31.1	1.8	1.52
3.2330	376.	88.	4.9	30.4	1.9	1.49
4.0030	376.	67.	4.9	30.7	1.9	1.50
4.0130	376.	67.	4.9	30.5	1.9	1.49
4.0230	393.	67.	4.9	30.4	1.6	1.47
4.0330	384.	67.	4.9	30.1	1.5	1.46
4.0430	394.	67.	4.9	29.2	1.8	1.43
4.0530	402.	67.	4.9	29.2	1.5	1.42
4.0630	402.	67.	4.9	29.8	1.5	1.41
4.0730	402.	67.	4.9	31.2	1.6	1.51
4.0830	402.	67.	4.9	30.3	1.9	1.49
4.0930	402.	57.	4.9	30.9	1.4	1.49
4.1030	402.	57.	4.9	30.7	1.6	1.49

APPENDIX F: TABLE 11.
RUN 8: GAS FLOW RATES PAGE 3 OF 12

DAY.HOUR	GASIFIER AIR	GASIFIER FLUE GAS	PILOT PROPANE	REGENERATION AIR	REGENERATION NITROGEN	REGEN. VELOCITY M/SEC
	G A S R A T E S M3/HR					
4.1130	402.	55.	4.9	33.8	1.8	1.61
4.1230	401.	57.	4.9	30.2	2.8	1.70
4.1330	399.	57.	4.9	34.4	1.9	1.68
4.1430	398.	57.	4.9	34.8	1.9	1.78
4.1530	387.	57.	4.9	34.8	1.8	1.62
4.1630	389.	57.	4.9	32.9	2.8	1.60
4.1730	388.	57.	4.5	32.6	2.4	1.59
4.1830	388.	57.	4.5	30.1	1.7	1.46
4.1930	388.	57.	4.5	28.9	1.6	1.46
4.2030	389.	57.	4.4	29.6	1.8	1.44
4.2130	389.	70.	4.4	30.2	2.2	1.49
4.2230	372.	67.	4.4	28.2	1.4	1.36
4.2330	372.	73.	4.4	30.9	1.6	1.40
5.0030	372.	73.	4.4	31.7	1.5	1.52
5.0130	372.	77.	4.4	30.5	1.4	1.47
5.0230	372.	70.	4.4	27.9	1.6	1.36
5.0330	372.	77.	4.4	31.4	1.6	1.52
5.0430	372.	58.	4.4	29.8	1.6	1.45
5.0530	372.	57.	4.4	29.2	1.5	1.41
5.0630	372.	65.	4.4	29.1	1.5	1.41
5.0730	372.	60.	4.4	28.8	1.4	1.35
5.0830	372.	60.	4.5	28.8	1.9	1.38
5.0930	MISSED DATA READING					
5.1030	MISSED DATA READING					
5.1130	375.	57.	4.5	30.8	1.9	1.46
5.1230	383.	88.	4.5	33.8	1.8	1.56
5.1330	383.	88.	4.5	33.2	2.1	1.62
5.1430	383.	44.	4.5	33.5	2.7	1.66
5.1530	379.	32.	4.5	34.8	2.3	1.69
5.1630	355.	48.	4.4	35.1	1.9	1.78
5.1730	355.	42.	4.4	35.1	1.6	1.68
5.1830	364.	58.	4.5	34.9	1.9	1.69
5.1930	364.	48.	4.4	34.2	2.8	1.67
5.2030	407.	61.	4.5	34.8	2.8	1.78
5.2130	372.	60.	4.5	34.6	1.8	1.67
5.2230	372.	67.	4.5	34.4	1.9	1.67
5.2330	372.	57.	4.5	34.5	1.7	1.66
6.0030	372.	57.	4.5	34.6	1.9	1.68
6.0130	372.	57.	4.5	33.8	1.6	1.63
6.0230	372.	67.	4.5	34.8	1.9	1.65

APPENDIX F: TABLE 11.
RUN 8: GAS FLOW RATES PAGE 4 OF 12

DAY.HOUR	G A S R A T E S M3/HR GASIFIER AIR	FLOW GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
6.0330	364.	87.	4.5	33.3	1.7	1.61
6.0430	364.	87.	4.5	33.1	1.6	1.60
6.0530	364.	87.	4.5	33.0	1.6	1.59
6.0630	364.	88.	4.5	33.0	1.6	1.59
6.0730	364.	88.	4.5	32.2	1.5	1.56
6.0830	364.	88.	4.5	33.0	2.4	1.62
6.0930	355.	88.	4.4	28.2	2.3	1.40
6.1030	355.	68.	4.4	25.2	1.8	1.25
6.1130	355.	68.	4.4	25.0	1.8	1.29
6.1230	355.	68.	4.4	25.4	1.6	1.26
6.1330	243.	68.	4.4	26.1	1.6	1.28
6.1430	351.	68.	4.4	25.5	1.7	1.26
6.1530	351.	68.	4.5	25.9	1.8	1.28
6.1630	351.	68.	4.5	25.8	1.8	1.28
6.1730	351.	75.	4.5	26.8	1.9	1.33
6.1830	351.	60.	4.5	26.4	1.8	1.31
6.1930	351.	68.	4.5	26.4	1.8	1.30
6.2030	352.	68.	4.4	25.9	1.9	1.29
6.2130	352.	68.	4.4	25.7	2.3	1.30
6.2230	353.	68.	4.4	26.2	1.7	1.29
6.2330	353.	68.	4.4	27.4	1.6	1.34
7.0030	353.	69.	4.4	27.3	1.9	1.35
7.0130	353.	68.	4.4	27.4	1.5	1.34
7.0230	353.	68.	4.4	27.5	2.0	1.36
7.0330	353.	68.	4.5	26.7	1.6	1.31
7.0430	353.	68.	4.5	26.8	1.6	1.31
7.0530	354.	68.	4.5	27.2	1.7	1.34
7.0630	354.	68.	4.4	26.4	1.7	1.30
7.0730	354.	68.	4.4	31.0	2.0	1.53
7.0830	355.	68.	4.4	29.5	1.7	1.26
7.0930	355.	68.	4.9	29.6	1.9	1.40
7.1030	329.	67.	4.9	29.9	2.5	1.49
7.1130	338.	88.	4.9	29.6	1.9	1.45
7.1230	338.	88.	4.9	29.5	1.7	1.44
7.1330	308.	67.	4.9	30.3	1.6	1.48
7.1430	320.	87.	4.9	30.2	2.0	1.49
7.1530	328.	87.	4.9	29.9	1.7	1.46
7.1630	320.	104.	4.9	30.1	1.5	1.40
7.1730	354.	99.	4.9	28.7	1.7	1.41
7.1830	354.	18.	4.9	29.6	1.8	1.45

APPENDIX B TABLE 11.
RUN 81 GAS FLOW RATES PAGE 5 OF 12

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
7.1930	328.	16.	4.9	30.8	1.9	1.52
7.2030	337.	13.	4.9	30.5	1.8	1.56
7.2130	327.	8.	4.9	30.7	2.8	1.52
7.2230	329.	8.	4.9	30.3	1.9	1.49
7.2330	329.	8.	4.9	31.8	1.9	1.52
8.0030	338.	87.	4.9	28.3	1.7	1.30
8.0130	338.	97.	4.9	28.4	1.7	1.39
8.0230	338.	97.	4.9	30.7	1.7	1.50
8.0330	338.	97.	4.9	29.5	1.7	1.42
8.0430	337.	97.	4.9	29.6	1.6	1.41
8.0530	337.	97.	4.9	29.8	1.7	1.45
8.0630	320.	107.	4.9	30.7	1.9	1.50
8.0730	328.	107.	4.9	29.3	1.6	1.42
8.0830	320.	107.	4.9	29.5	1.7	1.44
8.0930	320.	108.	4.9	29.2	1.5	1.42
8.1030	337.	109.	4.9	29.3	1.7	1.43
8.1130	337.	109.	4.9	29.2	1.5	1.42
8.1230	337.	99.	4.9	29.3	1.7	1.43
8.1330	336.	99.	4.9	29.6	1.6	1.44
8.1430	112.	99.	4.9	31.4	1.7	1.53
8.1530	112.	99.	4.9	31.4	1.7	1.53
8.1630	337.	99.	4.9	31.4	1.7	1.53
8.1730	337.	109.	4.9	30.8	1.5	1.49
8.1830	337.	99.	4.9	29.9	1.8	1.46
8.1930	337.	139.	4.9	35.8	1.6	1.72
8.2030	337.	139.	4.9	34.1	1.8	1.65
8.2130	337.	129.	4.9	33.4	2.1	1.63
8.2230	328.	129.	4.9	34.2	1.8	1.65
8.2330	329.	129.	4.9	28.7	1.8	1.31
9.0030	330.	129.	4.9	29.6	1.8	1.44
9.0130	321.	118.	4.9	29.2	1.7	1.42
9.0230	330.	118.	4.9	29.4	1.7	1.43
9.0330	321.	129.	4.9	29.6	1.7	1.44
9.0430	321.	129.	4.9	29.4	1.8	1.43
9.0530	321.	118.	4.9	29.8	1.7	1.45
9.0630	321.	118.	4.9	28.9	1.8	1.41
9.0730	330.	109.	4.9	30.1	1.7	1.46
9.0830	330.	109.	4.9	29.8	2.3	1.44
9.0930	329.	109.	4.9	29.2	1.8	1.39
9.1030	329.	109.	4.9	29.5	1.9	1.44

APPENDIX F: TABLE II.
RUN 8: GAS FLOW RATES PAGE 6 OF 12

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
9.1130	320.	109.	4.9	29.3	1.5	1.41
9.1230	320.	109.	4.9	30.4	1.7	1.40
9.1330	320.	109.	4.9	29.9	1.8	1.40
9.1430	320.	109.	4.9	28.3	1.8	1.38
9.1530	312.	109.	4.9	27.6	1.5	1.34
9.1630	312.	109.	4.9	30.9	1.7	1.40
9.1730	312.	109.	4.9	25.6	2.1	1.26
9.1830	303.	109.	4.9	25.8	1.5	1.21
9.1930	294.	98.	4.9	27.7	1.8	1.34
9.2030	303.	98.	4.9	26.3	1.5	1.26
9.2130	286.	98.	4.9	28.6	1.8	1.37
9.2230	285.	98.	4.9	28.6	1.7	1.36

SHUT DOWN AT 9.2230 FOR 23 HOURS

DAY.HOUR	GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
10.2230	358.	120.	4.5	24.2	1.8	1.13
10.2330	375.	108.	4.5	24.2	2.1	1.16
11.0030	375.	88.	4.5	24.3	1.9	1.08
11.0130	372.	88.	4.5	24.1	1.5	1.16
11.0230	372.	88.	4.5	23.5	1.6	1.18
11.0330	389.	68.	4.4	27.8	1.9	1.36
11.0430	389.	68.	4.4	30.7	2.3	1.43
11.0530	389.	109.	4.4	30.1	1.9	1.47
11.0630	376.	88.	4.4	30.0	2.0	1.47
11.0730	376.	88.	4.4	29.3	2.2	1.45

SHUT DOWN AT 11.0730 FOR 19 HOURS

DAY.HOUR	GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
12.0330	370.	30.	4.4	26.7	2.0	1.28
12.0430	334.	61.	4.4	27.4	2.2	1.26
12.0530	335.	63.	4.4	28.8	2.8	1.38
12.0630	368.	66.	4.4	24.2	2.3	1.18
12.0730	352.	27.	4.5	26.3	1.9	1.25
12.0830	334.	40.	4.5	29.8	2.5	1.44
12.0930	370.	39.	4.5	26.2	2.4	1.28
12.1030	370.	33.	4.5	25.3	2.8	1.24
12.1130	370.	26.	4.5	24.6	1.6	1.18
12.1230	361.	24.	4.5	26.8	1.6	1.29

APPENDIX F: TABLE 11.
RUN 8: GAS FLOW RATES   PAGE 7 OF 12

DAY.HOUR	G A S R A T E S M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
12.1330	353.	24.	4.5	26.9	1.9	1.31
12.1430	351.	58.	4.5	26.3	1.6	1.23
12.1530	353.	48.	4.5	25.7	1.6	1.21
12.1630	353.	34.	4.5	26.5	1.5	1.28
12.1730	353.	20.	4.5	27.5	1.7	1.33
12.1830	351.	22.	4.5	26.3	1.6	1.27
12.1930	351.	37.	4.5	25.9	1.5	1.25
12.2030	353.	33.	4.5	25.5	1.6	1.24
12.2130	353.	34.	4.5	25.2	1.5	1.22
12.2230	353.	31.	4.5	26.8	1.6	1.25
12.2330	353.	31.	4.5	26.2	1.7	1.26
13.0030	370.	27.	4.4	32.5	1.7	1.50
13.0130	370.	28.	4.4	37.4	2.8	1.80
13.0230	353.	44.	4.4	34.4	1.9	1.65
13.0330	353.	15.	4.4	34.7	1.8	1.66
13.0430	353.	21.	4.4	33.2	1.9	1.59
13.0530	353.	17.	4.4	31.7	1.9	1.51
13.0630	353.	22.	4.5	34.4	2.1	1.65
13.0730	351.	21.	4.4	32.2	2.5	1.62
13.0830	353.	21.	4.4	31.6	2.7	1.55
13.0930	353.	21.	4.6	31.6	2.5	1.58
13.1030	353.	21.	4.6	31.2	1.9	1.50
13.1130	353.	17.	4.9	30.7	1.7	1.47
13.1230	370.	17.	4.9	30.9	1.7	1.49
13.1330	371.	18.	4.9	31.1	1.7	1.51
13.1430	370.	15.	4.9	31.2	1.6	1.51
13.1530	370.	15.	4.9	30.9	1.7	1.50
13.1630	387.	13.	4.9	30.5	1.7	1.47
13.1730	386.	13.	4.9	30.6	1.7	1.48
13.1830	387.	13.	4.9	30.5	1.7	1.48
13.1930	388.	8.	4.9	30.8	1.7	1.49
13.2030	388.	8.	4.9	30.6	1.7	1.48
13.2130	389.	8.	4.9	30.4	1.6	1.46
13.2230	389.	5.	4.9	30.2	1.8	1.47
13.2330	389.	16.	4.9	29.6	1.5	1.43
14.0030	389.	18.	4.9	30.5	1.5	1.47
14.0130	389.	11.	4.9	30.6	1.5	1.49
14.0230	389.	5.	4.9	30.8	1.5	1.48
14.0330	390.	5.	4.9	30.3	1.5	1.46
14.0430	390.	5.	4.9	30.8	1.8	1.50

APPENDIX B TABLE 11.
RUN 8 GAS FLOW RATES PAGE 8 OF 12

DAY.HOUR	G A S R A T E S M3/HR GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
14.0530	397.	5.	4.9	30.6	1.6	1.48
14.0630	406.	5.	4.9	31.1	1.4	1.49
14.0730	406.	5.	4.9	30.8	1.5	1.48
14.0830	406.	5.	4.9	30.3	1.5	1.46
14.0930	389.	5.	4.9	30.2	1.6	1.46
14.1030	388.	2.	4.9	29.9	1.5	1.44
14.1130	388.	2.	4.9	29.5	1.4	1.42
14.1230	388.	2.	4.9	29.3	1.5	1.41
14.1330	388.	2.	4.9	29.5	1.5	1.42
14.1430	387.	2.	4.9	29.2	1.5	1.40
14.1530	388.	2.	4.9	29.4	1.5	1.41
14.1630	388.	2.	4.9	30.4	1.5	1.46
14.1730	405.	2.	4.9	30.6	1.5	1.47
14.1830	407.	5.	4.9	31.3	1.6	1.50
14.1930	407.	5.	4.9	31.8	1.6	1.49
14.2030	407.	5.	5.8	31.9	1.7	1.53
14.2130	408.	5.	5.8	33.1	1.8	1.60
14.2230	398.	5.	5.8	33.6	1.9	1.62
14.2330	398.	5.	5.8	32.8	1.8	1.59
15.0030	398.	5.	4.9	34.2	2.2	1.67
15.0130	407.	5.	4.9	37.8	1.8	1.78
15.0230	407.	5.	4.9	38.9	2.5	1.89
15.0330	407.	5.	4.9	39.7	2.2	1.92
15.0430	408.	5.	4.9	39.1	1.8	1.88
15.0530	406.	5.	4.9	39.7	1.8	1.90
15.0630	405.	5.	4.9	39.8	1.8	1.91
15.0730	387.	5.	4.9	39.8	2.2	1.92
15.0830	405.	11.	4.9	39.8	1.9	1.88
15.0930	405.	11.	4.9	38.8	1.7	1.81
15.1030	405.	11.	4.9	37.7	1.8	1.80
15.1130	387.	10.	4.9	36.6	1.6	1.75
15.1230	387.	10.	4.9	35.3	1.6	1.69
15.1330	387.	10.	4.9	34.8	1.6	1.66
15.1430	386.	10.	5.8	33.8	1.5	1.61
15.1530	385.	10.	5.8	32.3	1.4	1.54
15.1630	385.	10.	5.8	30.7	1.3	1.46
15.1730	386.	11.	5.8	29.8	1.3	1.43
15.1830	386.	11.	5.8	30.3	1.3	1.45
15.1930	404.	8.	4.9	30.6	1.3	1.47
15.2030	404.	6.	4.9	30.5	1.4	1.47

APPENDIX F: TABLE 11.
RUN 8: GAS FLOW RATES   PAGE 9 OF 12

DAY.HOUR	G A S R A T E S M3/HR GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
15.2130	404.	8.	4.9	30.5	1.4	1.47
15.2230	405.	8.	4.9	31.5	1.5	1.52
15.2330	405.	8.	4.9	31.0	1.5	1.50
16.0030	406.	8.	4.9	32.8	1.5	1.54
16.0130	405.	8.	4.9	32.6	1.2	1.55
16.0230	405.	11.	4.9	34.4	1.8	1.60
16.0330	404.	11.	4.9	31.3	1.5	1.51
16.0430	404.	11.	4.9	29.6	1.8	1.44
16.0530	404.	10.	4.9	31.7	1.9	1.54
16.0630	404.	11.	4.9	32.8	1.6	1.50
16.0730	404.	11.	4.9	32.2	1.4	1.54
16.0830	404.	12.	4.9	30.3	1.6	1.46
16.0930	404.	12.	4.9	30.1	1.5	1.44
16.1030	404.	88.	4.9	32.0	1.5	1.51
16.1130	404.	88.	4.9	33.7	1.4	1.60
16.1230	404.	91.	4.9	32.0	1.4	1.52
16.1330	421.	63.	4.9	31.3	1.4	1.49
16.1430	369.	18.	4.9	35.3	1.5	1.69
16.1530	389.	13.	4.9	36.4	1.5	1.75
16.1630	404.	13.	4.9	36.7	1.7	1.77
16.1730	404.	13.	4.9	38.1	1.9	1.84
16.1830	404.	13.	4.9	37.8	1.8	1.76
16.1930	404.	13.	4.9	34.6	1.8	1.60
16.2030	404.	8.	4.9	32.8	1.6	1.50
16.2130	404.	5.	4.9	31.3	1.7	1.51
16.2230	352.	12.	4.4	35.8	1.7	1.72
16.2330	352.	9.	4.4	33.4	2.0	1.63
17.0030	352.	18.	4.4	26.3	1.5	1.27
17.0130	352.	19.	4.6	29.0	1.5	1.40
17.0230	389.	15.	4.5	27.9	1.9	1.37
17.0330	352.	15.	4.4	33.4	2.4	1.63
17.0430	352.	15.	4.4	33.7	2.7	1.65
17.0530	337.	14.	4.4	30.0	1.5	1.43
17.0630	337.	14.	4.4	28.5	1.6	1.36
17.0730	354.	17.	4.4	24.1	2.4	1.09
17.0830	371.	13.	4.4	37.5	1.7	1.77
17.0930	372.	27.	4.4	31.9	1.5	1.52
17.1030	371.	50.	4.4	34.5	1.3	1.62
17.1130	371.	57.	4.5	33.5	2.5	1.64
17.1230	371.	62.	4.5	30.7	2.8	1.50

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                      APPENDIX B  TABLE 11.
                   RUN 81  GAS FLOW RATES     PAGE 10 OF 12

                     G A S    R A T E S   M3/HR        REGEN.
DAY.HOUR        GASIFIER       PILOT      REGENERATOR  VELOCITY
              AIR  FLUE GAS   PROPANE    AIR  NITROGEN   M/SEC

17.1330       371.     50.      4.5      35.6    2.3      1.72
17.1430       370.     42.      4.5      38.2    1.7      1.84
17.1530       405.     17.      4.5      37.4    2.1      1.81
17.1630       370.     16.      4.5      37.5    1.9      1.79
17.1730       370.     17.      4.5      37.5    2.1      1.81
17.1830              MISSED DATA READING
17.1930              MISSED DATA READING
17.2030       371.     16.      4.4      38.8    2.5      1.86
17.2130       371.     15.      4.4      28.2    2.3      1.38
17.2230       388.     17.      4.4      32.2    2.6      1.57
17.2330       377.     17.      4.4      36.5    1.7      1.76
18.0030       371.     23.      4.4      36.7    1.5      1.74
18.0130       371.     22.      4.4      35.6    1.5      1.71
18.0230       371.     19.      4.4      35.7    1.6      1.70
18.0330       371.     19.      4.4      35.8    1.8      1.72
18.0430       371.     16.      4.4      35.4    1.8      1.69
18.0530       371.     16.      4.4      28.9    1.5      1.39
18.0630       371.     23.      4.4      36.4    1.2      1.72
18.0730       371.     16.      4.4      35.5    1.9      1.71
18.0830       371.     17.      4.4      35.2    1.7      1.68
18.0930       371.     17.      4.4      43.9    1.5      2.08
18.1030       372.     16.      4.4      25.2    1.4      1.21
18.1130       372.     16.      4.4      28.3    1.3      1.35
18.1230       372.     16.      4.4      28.0    1.4      1.34
18.1330       354.     16.      4.4      37.0    1.5      1.76
18.1430       354.     15.      4.4      39.0    1.4      1.85
18.1530       355.     15.      4.5      39.0    1.6      1.87
18.1630       355.     12.      4.5      38.9    1.6      1.85
18.1730       372.     15.      4.5      38.1    1.5      1.80
18.1830       372.     15.      4.5      36.0    1.7      1.71
18.1930       372.     12.      4.5      36.8    2.7      1.77
18.2030       372.     15.      4.5      36.6    3.1      1.81
18.2130       372.     12.      4.5      37.1    2.3      1.80
18.2230       414.     12.      4.5      36.9    1.6      1.75
18.2330       372.     14.      4.5      37.0    1.9      1.77
19.0030       372.     15.      4.5      34.2    1.7      1.63
19.0130       372.     16.      4.5      37.0    2.0      1.77
19.0230       372.     16.      4.5      36.5    1.5      1.72
19.0330       372.     15.      4.5      36.7    1.5      1.71
19.0430       372.     16.      4.5      35.7    1.5      1.68
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APPENDIX F TABLE 11. PAGE 11 OF 12
RUN 81 GAS FLOW RATES

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	GASIFIER FLUE GAS	PILOT PROPANE	REGENERATOR AIR	REGENERATOR NITROGEN	REGEN. VELOCITY M/SEC
19.0530	372.	16.	4.5	35.1	1.3	1.05
19.0630	372.	17.	4.5	34.5	1.3	1.02
19.0730	355.	15.	4.6	31.6	1.4	1.49
19.0830	370.	17.	4.6	33.6	1.6	1.57
19.0930	372.	17.	4.9	32.6	1.8	1.56
19.1030	355.	22.	4.9	33.6	1.8	1.59
19.1130	364.	15.	4.9	32.4	1.8	1.55
19.1230	378.	16.	4.9	33.4	2.4	1.62
19.1330	337.	14.	4.9	32.4	1.6	1.64
19.1430	328.	61.	4.9	32.0	1.8	1.56
19.1530	328.	67.	4.9	32.0	1.8	1.57
19.1630	363.	57.	4.9	32.7	1.6	1.55
19.1730	389.	61.	4.9	35.0	1.8	1.74

SHUT DOWN AT 19.1730 FOR 36 HOURS

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	GASIFIER FLUE GAS	PILOT PROPANE	REGENERATOR AIR	REGENERATOR NITROGEN	REGEN. VELOCITY M/SEC
21.0630	370.	18.	4.9	31.1	1.8	1.47
21.0730	369.	18.	4.9	35.8	1.7	1.66
21.0830	369.	18.	4.9	33.4	1.8	1.61
21.0930	369.	16.	4.9	33.6	1.4	1.63
21.1030	371.	16.	4.9	33.6	1.6	1.59
21.1130	354.	18.	4.9	31.6	1.8	1.54
21.1230	353.	20.	4.9	32.6	1.8	1.59
21.1330	370.	18.	4.9	32.0	1.5	1.58
21.1430	364.	15.	4.9	33.7	1.6	1.70
21.1530	371.	19.	4.9	35.4	1.5	1.70
21.1630	371.	18.	4.9	35.7	1.6	1.71
21.1730	371.	18.	4.9	35.7	1.6	1.71
21.1830	364.	18.	4.9	35.7	1.6	1.72
21.1930	354.	18.	4.9	35.7	1.4	1.72
21.2030	320.	21.	4.9	34.7	1.8	1.69
21.2130	388.	14.	4.9	38.1	2.0	1.69
21.2230	389.	14.	4.9	38.9	2.7	1.74
21.2330	389.	14.	4.9	38.9	1.6	2.06
22.0030	391.	13.	4.9	38.8	2.6	1.71
22.0130	391.	14.	4.9	36.5	1.7	1.66
22.0230	391.	13.	4.9	38.5	1.7	1.74
22.0330	391.	13.	4.9	36.1	1.7	1.72
22.0430	391.	13.	4.9	36.7	1.6	1.73

APPENDIX F: TABLE 11.
RUN 5: GAS FLOW RATES   PAGE 12 OF 12

DAY.HOUR	G A S	R A T E S	M3/HR			REGEN.
	GASIFIER		PILOT	REGENERATOR		VELOCITY
	AIR	FLUE GAS	PROPANE	AIR	NITROGEN	M/SEC
22.0530	391.	13.	4.9	34.1	1.7	1.80
22.0630	391.	13.	4.9	36.5	1.7	1.77
22.0730	390.	13.	4.9	35.6	1.7	1.72
22.0830	390.	13.	4.9	35.3	2.0	1.73
22.0930	390.	8.	4.9	34.9	1.9	1.70
22.1030	387.	7.	4.9	32.3	1.7	1.59
22.1130	387.	10.	4.9	30.8	1.5	1.57
22.1230	382.	9.	4.9	30.3	1.5	1.48
22.1330	379.	7.	4.9	30.2	1.5	1.47
22.1430	379.	10.	4.9	29.5	1.5	1.43
22.1530		MISSED DATA READING				
22.1630	379.	8.	4.9	31.5	1.5	1.53

APPENDIX V: TABLE III.
RUN 8: PRESSURES PAGE 1 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
1.0330	2.2	1.8	5.4	1.00	4.7
1.0430	2.1	1.8	6.2	1.00	4.7
1.0530	2.4	2.1	2.9	1.00	5.6
1.0630	2.2	2.1	2.1	0.95	5.5
1.0730	2.2	2.0	6.2	1.00	6.5
1.0830	2.3	2.1	3.6	1.00	7.0
1.0930	2.1	2.0	6.3	1.00	7.0
1.1030	2.1	2.1	7.3	1.00	7.0
1.1130	2.1	2.0	7.2	0.90	7.0
1.1230	2.2	2.1	7.5	0.95	7.0
1.1330	2.3	2.2	7.9	1.02	9.3
1.1430	2.4	2.3	7.7	0.95	9.0
1.1530	2.4	2.1	7.8	0.90	7.2
1.1630	2.4	2.1	8.6	1.00	7.5
1.1730	2.4	2.1	8.2	0.90	8.0
1.1830	2.4	2.1	9.0	1.00	9.5
1.1930	2.4	2.1	9.6	1.00	8.0
1.2030	2.4	2.1	9.2	1.00	8.7
1.2130	2.4	2.0	9.2	1.00	7.5
1.2230	2.4	2.1	9.2	1.00	8.0
1.2330	2.4	2.1	9.1	1.00	8.7
2.0030	2.5	2.0	9.2	1.00	8.5
2.0130	2.5	2.0	9.1	1.02	8.0
2.0230	2.3	1.9	9.3	1.02	7.7
2.0330	2.2	1.9	9.0	1.05	8.7
2.0430	2.2	1.9	9.0	1.05	8.7
2.0530	2.5	1.9	9.6	1.00	8.7
2.0630	2.4	1.9	9.5	1.00	8.7
2.0730	2.3	2.0	9.8	0.97	9.2
2.0830	2.3	1.9	9.5	0.97	9.2
2.0930	2.2	1.9	9.7	1.00	9.0
2.1030	2.2	1.9	9.8	1.02	8.7
2.1130	2.2	2.2	10.1	1.02	9.0
2.1230	2.2	2.2	10.0	1.00	8.7
2.1330	2.2	2.1	9.2	1.00	8.2
2.1430	2.3	2.1	9.3	0.90	8.5
2.1530	2.3	2.5	9.3	0.90	8.7
2.1630	2.4	2.5	9.1	1.00	8.7
2.1730	2.5	2.5	8.8	1.00	8.5
2.1830	2.5	2.5	8.8	1.02	8.0

APPENDIX B TABLE III.

RUN 8: PRESSURES PAGE 2 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
2.1930	2.7	2.5	8.7	1.02	8.2
2.2030	2.8	2.7	8.5	0.98	8.5
2.2130	2.8	4.7	8.2	0.92	7.5
2.2230	2.9	3.2	8.5	0.97	7.5
2.2330	2.9	3.8	8.5	0.97	8.5
3.0030	2.9	2.9	8.3	1.03	7.7
3.0130	3.1	3.1	7.7	0.93	7.2
3.0230	3.6	3.1	7.6	1.00	7.5
3.0330	4.1	4.7	7.5	0.97	8.2
3.0430	4.2	4.6	7.2	1.06	7.5
3.0530	4.1	4.7	7.3	0.97	7.5
3.0630	4.4	4.7	7.3	1.05	7.5
3.0730	4.2	5.8	7.1	0.93	7.8
3.0830	4.6	5.8	6.7	0.95	7.8
3.0930	4.2	4.2	6.8	0.95	6.8
3.1030	3.5	3.8	6.8	0.98	5.8
3.1130	3.3	3.8	5.7	1.00	5.5
3.1230	3.4	2.7	6.8	0.98	6.8
3.1330	3.4	2.7	6.2	1.00	6.8
3.1430	3.4	2.7	6.6	1.00	6.2
3.1530	3.2	2.6	6.8	1.02	6.7
3.1630	3.1	2.6	7.2	1.00	7.2
3.1730	3.2	2.7	7.3	1.00	7.2
3.1830	3.2	2.7	7.3	0.98	7.8
3.1930	3.2	2.7	7.3	1.00	7.2
3.2030	3.1	2.6	7.6	1.00	7.8
3.2130	3.1	2.6	7.6	1.00	7.8
3.2230	3.1	2.9	7.6	0.95	6.5
3.2330	3.1	2.6	7.7	1.00	7.8
4.0030	3.1	2.7	7.8	1.00	7.5
4.0130	3.1	2.6	8.8	1.00	7.5
4.0230	3.0	2.6	8.1	1.00	7.8
4.0330	3.0	2.6	8.1	1.00	7.5
4.0430	2.9	2.7	8.3	0.95	7.5
4.0530	2.9	2.7	8.6	0.97	8.0
4.0630	2.9	2.7	9.1	0.95	8.5
4.0730	2.9	2.7	8.7	0.95	7.5
4.0830	3.0	2.7	8.6	1.00	8.0
4.0930	3.0	2.6	8.7	1.03	7.8
4.1030	3.0	2.6	8.5	1.00	7.8

APPENDIX B TABLE III.
RUN 81 PRESSURES PAGE 3 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
4.1130	3.0	2.6	8.2	1.00	6.3
4.1230	3.1	2.7	8.1	1.00	6.2
4.1330	3.1	2.7	8.4	1.00	6.2
4.1430	3.0	2.7	8.4	1.00	6.3
4.1530	3.0	2.7	8.7	1.05	6.2
4.1630	3.1	2.7	8.5	1.05	7.2
4.1730	2.9	2.7	8.5	1.10	8.2
4.1830	2.9	2.6	8.7	1.10	8.2
4.1930	2.8	2.6	8.7	1.10	8.7
4.2030	2.9	2.6	8.7	1.15	8.7
4.2130	2.7	2.6	8.9	1.15	8.7
4.2230	2.9	2.6	9.0	1.20	8.7
4.2330	3.0	2.6	9.0	1.10	8.7
5.0030	2.9	2.7	9.1	1.15	8.7
5.0130	2.9	2.7	9.1	1.10	8.7
5.0230	2.9	2.7	9.2	1.10	8.7
5.0330	2.9	2.7	9.3	1.15	8.7
5.0430	2.7	2.2	9.6	0.90	8.7
5.0530	2.9	2.2	9.5	0.90	8.7
5.0630	2.9	2.2	9.5	0.90	8.7
5.0730	2.9	2.2	9.3	0.90	9.5
5.0830	2.7	2.8	9.5	1.00	9.5
5.0930		MISSED DATA READING			
5.1030		MISSED DATA READING			
5.1130	3.0	2.2	9.8	0.95	9.5
5.1230	3.4	2.5	9.8	1.00	9.5
5.1330	3.1	2.4	9.8	1.00	9.5
5.1430	3.2	2.5	9.8	1.00	9.5
5.1530	3.0	2.2	9.8	1.00	9.5
5.1630	3.0	2.2	9.8	1.00	9.8
5.1730	3.1	2.2	9.9	1.00	9.5
5.1830	3.0	2.2	9.3	1.00	9.5
5.1930	2.9	2.2	9.3	1.00	9.5
5.2030	2.9	2.5	9.3	1.00	9.5
5.2130	2.9	2.2	9.2	1.00	9.5
5.2230	2.9	2.2	9.2	1.00	9.5
5.2330	2.7	2.2	9.5	0.90	9.5
6.0030	2.6	2.2	9.7	1.00	9.5
6.0130	2.5	2.8	9.7	1.00	9.5
6.0230	2.6	2.8	9.5	1.00	9.5

APPENDIX B TABLE III.
RUN 8: PRESSURES PAGE 4 OF 12

	GASIFIER P. KILOPASCALS			GASIFIER	REGEN.
DAY.HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	BED SP. GR.	BED D.P.
6.0330	2.6	2.5	9.6	0.90	9.5
6.0430	2.7	2.2	9.6	0.95	9.5
6.0530	2.6	2.5	9.7	1.00	9.5
6.0630	2.6	2.0	9.8	1.00	9.5
6.0730	2.6	2.2	10.0	1.00	9.5
6.0830	2.5	2.2	10.0	1.00	9.5
6.0930	2.6	2.1	9.7	1.00	9.5
6.1030	2.9	2.0	9.2	1.00	9.5
6.1130	2.6	2.1	9.7	1.00	10.0
6.1230	2.7	2.0	9.7	1.00	10.0
6.1330	2.7	2.0	9.7	1.00	10.0
6.1430	2.7	2.0	9.7	1.00	10.0
6.1530	2.7	2.0	9.7	1.05	10.0
6.1630	2.9	2.0	9.3	1.05	9.3
6.1730	2.9	2.0	9.2	1.10	9.2
6.1830	3.0	2.2	9.2	1.00	9.2
6.1930	3.0	2.0	9.2	1.00	9.2
6.2030	3.0	2.0	9.5	1.00	10.0
6.2130	2.6	2.0	9.3	1.00	10.0
6.2230	2.7	2.0	9.5	1.00	9.5
6.2330	2.7	2.1	9.5	1.00	10.0
7.0030	2.7	2.2	9.5	1.10	10.0
7.0130	2.7	2.2	9.5	1.00	9.7
7.0230	2.7	2.2	9.5	1.00	9.7
7.0330	2.6	2.1	9.5	0.90	9.5
7.0430	2.9	2.2	9.5	0.90	9.2
7.0530	2.7	2.2	9.5	0.90	9.5
7.0630	2.7	2.2	9.3	1.00	10.0
7.0730	2.6	2.2	9.5	1.00	8.7
7.0830	2.7	2.2	9.1	1.00	8.7
7.0930	2.9	2.2	9.1	1.00	8.7
7.1030	3.1	2.5	9.1	1.00	8.7
7.1130	3.0	2.4	9.2	0.95	8.7
7.1230	2.9	2.5	9.2	0.95	8.7
7.1330	2.9	2.4	9.1	1.00	8.7
7.1430	2.9	2.5	9.0	1.00	8.7
7.1530	3.0	2.5	9.0	1.00	8.7
7.1630	3.0	2.5	9.0	1.00	8.7
7.1730	2.6	2.1	9.1	1.00	8.7
7.1830	2.6	2.1	9.1	0.95	8.7

APPENDIX F.A TABLE III.
RUN 87 PRESSURES PAGE 5 OF 12

DAY.HOUR	GASIFIER P. KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
7.1930	2.6	2.8	9.0	0.92	8.7
7.2030	2.6	2.6	9.1	0.91	8.7
7.2130	2.7	1.9	9.2	0.89	8.7
7.2230	2.7	1.9	9.2	0.86	8.7
7.2330	2.9	2.1	9.3	0.88	9.0
8.0030	3.2	2.5	9.1	0.91	8.7
8.0130	3.3	2.6	9.3	0.96	9.3
8.0230	3.4	2.4	9.2	1.00	9.2
8.0330	3.1	2.4	9.3	0.98	9.3
8.0430	3.1	2.5	9.3	1.00	9.5
8.0530	3.2	2.5	9.2	0.98	9.0
8.0630	3.2	2.5	9.3	1.00	9.2
8.0730	3.2	2.4	9.3	1.00	9.0
8.0830	3.1	2.5	9.2	0.95	9.0
8.0930	3.0	2.6	9.2	0.98	8.7
8.1030	3.0	2.6	9.2	0.94	8.7
8.1130	3.0	2.5	9.1	0.97	8.7
8.1230	3.0	2.5	9.0	1.00	8.7
8.1330	3.0	2.4	9.0	1.02	9.0
8.1430	3.0	2.4	9.0	1.00	8.7
8.1530	3.0	2.4	9.0	1.00	8.7
8.1630	3.0	2.4	9.0	0.98	8.7
8.1730	3.0	2.4	9.0	0.98	9.0
8.1830	3.1	2.5	9.0	1.00	9.0
8.1930	3.4	2.9	7.8	0.97	7.5
8.2030	3.6	3.0	7.5	0.97	7.2
8.2130	3.6	3.0	7.5	0.98	6.7
8.2230	3.5	2.7	7.7	0.98	6.5
8.2330	3.6	2.8	7.7	1.00	7.0
9.0030	3.5	2.7	7.5	1.00	7.2
9.0130	3.6	2.8	7.5	1.00	7.2
9.0230	3.6	2.6	7.5	1.00	6.7
9.0330	3.6	2.7	7.5	1.00	6.5
9.0430	3.5	2.6	7.7	0.98	6.5
9.0530	3.5	2.6	7.6	1.00	6.5
9.0630	3.5	2.6	7.6	1.00	6.7
9.0730	3.4	2.5	7.7	1.00	6.7
9.0830	3.4	2.5	7.7	1.00	6.7
9.0930	3.3	2.6	7.6	0.96	7.0
9.1030	3.5	2.6	7.6	0.97	7.0

APPENDIX 9: TABLE III.
RUN 8: PRESSURES PAGE 6 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
9.1130	3.5	2.5	7.5	1.00	7.2
9.1230	3.5	2.4	6.7	1.00	7.0
9.1330	3.6	2.4	6.1	0.97	5.5
9.1430	3.7	2.4	6.1	1.02	5.5
9.1530	3.9	2.4	5.2	0.98	5.8
9.1630	3.9	2.2	5.4	1.00	5.7
9.1730	4.0	2.2	5.4	1.00	5.7
9.1830	4.0	2.2	5.5	1.05	6.0
9.1930	4.2	2.2	5.5	0.95	5.8
9.2030	4.5	2.2	5.5	1.00	5.8
9.2130	5.2	2.1	5.5	0.91	5.8
9.2230	6.2	2.0	5.7	1.00	5.8

SHUT DOWN AT 9.2230 FOR 23 HOURS

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
10.2230	2.7	3.0	6.8	1.00	7.0
10.2330	2.7	2.9	7.2	1.00	8.0
11.0030	2.6	2.7	7.2	1.00	8.0
11.0130	2.6	2.6	7.5	1.00	8.0
11.0230	2.7	2.4	7.6	1.00	8.0
11.0330	2.7	2.6	7.7	1.00	7.5
11.0430	2.9	2.6	7.6	1.00	7.5
11.0530	3.0	2.6	7.5	1.00	7.5
11.0630	3.1	3.0	7.5	1.00	7.5
11.0730	3.1	3.0	7.5	1.00	7.5

SHUT DOWN AT 11.0730 FOR 19 HOURS

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
12.0330	2.7	2.2	7.2	1.00	9.0
12.0430	3.0	2.7	7.0	1.00	8.7
12.0530	2.7	2.2	7.0	1.00	8.7
12.0630	2.7	2.1	7.0	1.00	8.7
12.0730	2.7	2.1	7.0	1.00	8.7
12.0830	2.8	2.2	8.1	1.00	8.2
12.0930	2.5	2.5	7.0	1.00	7.5
12.1030	2.7	2.2	7.2	1.10	7.5
12.1130	2.8	2.2	7.5	1.00	7.5
12.1230	2.7	2.1	7.5	1.10	7.5

APPENDIX F: TABLE III.
RUN 8: PRESSURES PAGE 7 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
12.1330	2.6	2.1	7.7	1.00	7.5
12.1430	2.6	2.2	8.8	1.00	7.5
12.1530	2.6	2.2	8.8	1.00	7.5
12.1630	2.6	2.2	8.5	1.00	9.0
12.1730	3.0	2.2	8.5	1.00	9.0
12.1830	2.9	2.2	8.5	1.30	8.7
12.1930	2.9	2.5	8.7	1.00	8.0
12.2030	2.9	2.2	8.7	1.00	8.2
12.2130	3.0	2.2	9.1	1.00	8.2
12.2230	3.0	2.2	8.7	1.00	8.2
12.2330	3.0	2.2	8.7	1.00	8.2
13.0030	3.1	2.2	8.7	1.00	6.2
13.0130	3.1	2.2	8.7	1.00	7.5
13.0230	3.1	2.2	8.8	1.00	8.5
13.0330	3.1	2.1	9.0	1.00	8.7
13.0430	3.1	2.1	8.7	1.05	8.7
13.0530	3.1	2.0	8.5	1.00	8.7
13.0630	3.1	2.0	8.7	1.00	8.7
13.0730	3.1	2.0	8.5	1.00	8.7
13.0830	3.1	2.0	8.6	1.00	8.7
13.0930	3.1	2.0	8.6	1.00	8.7
13.1030	3.1	2.0	8.7	0.98	8.7
13.1130	3.1	2.1	8.7	0.95	8.7
13.1230	3.2	2.2	8.7	1.00	8.7
13.1330	3.2	2.2	8.7	1.00	8.7
13.1430	3.2	2.3	8.7	1.00	8.7
13.1530	3.4	2.2	8.7	1.00	8.7
13.1630	3.4	2.2	8.7	0.98	8.7
13.1730	3.2	2.2	8.7	0.98	8.7
13.1830	3.2	2.2	8.7	1.00	8.7
13.1930	3.3	2.2	8.7	1.00	8.7
13.2030	3.2	2.2	8.7	1.00	8.7
13.2130	3.2	2.2	8.7	1.00	9.0
13.2230	3.1	2.1	9.0	1.00	9.0
13.2330	3.1	2.4	8.8	1.00	9.0
14.0030	3.1	2.2	8.8	1.00	9.0
14.0130	3.1	2.1	8.8	1.00	8.7
14.0230	3.1	2.1	8.8	1.00	8.7
14.0330	3.1	2.2	8.8	1.00	8.7
14.0430	3.1	2.2	9.0	0.97	8.7

APPENDIX F: TABLE III.
RUN 8: PRESSURES PAGE 8 OF 12

DAY.HOUR	GASIFIER P. KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
14.0530	3.1	2.2	8.8	1.00	8.7
14.0630	3.1	2.2	8.7	1.00	8.7
14.0730	3.1	2.2	8.7	1.00	8.7
14.0830	3.1	2.2	8.7	1.00	8.7
14.0930	3.2	2.4	8.7	0.99	8.7
14.1030	3.4	2.2	8.8	0.98	8.7
14.1130	3.4	2.2	8.7	1.00	8.7
14.1230	3.5	2.2	8.7	1.00	8.7
14.1330	3.5	2.2	8.7	1.00	8.7
14.1430	3.5	2.2	8.7	1.00	8.7
14.1530	3.5	2.2	9.0	1.00	8.7
14.1630	3.5	2.2	9.0	1.00	8.7
14.1730	3.5	2.5	9.0	1.00	8.7
14.1830	3.5	2.2	9.0	1.00	8.7
14.1930	3.7	2.4	9.0	1.00	8.7
14.2030	3.6	2.4	9.0	1.00	8.7
14.2130	3.2	2.2	8.7	1.00	8.7
14.2230	3.2	2.1	8.7	1.00	8.7
14.2330	3.4	2.2	8.6	1.00	8.7
15.0030	3.4	2.2	8.6	1.00	8.7
15.0130	3.4	2.2	8.7	1.00	8.7
15.0230	3.4	2.2	8.6	1.05	8.7
15.0330	3.4	2.2	8.7	1.00	8.7
15.0430	3.4	2.2	8.7	1.00	8.7
15.0530	3.4	2.2	8.7	1.03	8.7
15.0630	3.4	2.2	8.6	1.00	8.7
15.0730	3.4	2.2	8.6	1.00	8.7
15.0830	3.4	2.2	8.7	1.00	8.7
15.0930	3.6	2.2	8.7	1.00	8.7
15.1030	3.4	2.2	8.7	1.00	8.7
15.1130	3.4	2.2	8.7	1.00	8.7
15.1230	3.5	2.2	9.0	1.01	9.0
15.1330	3.5	2.1	9.2	0.95	9.0
15.1430	3.5	2.1	9.3	0.95	9.2
15.1530	3.4	2.1	9.5	1.000	9.5
15.1630	3.4	2.1	9.7	1.00	9.7
15.1730	3.5	2.1	10.0	1.00	10.0
15.1830	3.6	2.1	9.8	1.00	10.0
15.1930	3.5	2.1	10.2	1.00	10.2
15.2030	3.5	2.2	10.1	1.00	10.3

APPENDIX N TABLE III.
RUN 8: PRESSURES PAGE 9 OF 12

DAY.HOUR	GASIFIER P. KILOPASCALS GAS SPACE	DISTR'R. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
15.2130	3.2	2.1	9.5	0.97	10.5
15.2230	3.3	2.2	10.0	0.97	10.0
15.2330	3.2	2.1	10.0	1.00	10.0
16.0030	3.2	2.2	9.8	0.96	10.0
16.0130	3.4	2.2	9.8	0.97	10.0
16.0230	3.4	2.2	9.7	1.00	10.0
16.0330	3.2	2.1	10.0	1.00	10.5
16.0430	3.4	2.1	9.8	1.00	10.5
16.0530	3.4	2.1	10.0	1.00	10.0
16.0630	3.4	2.1	10.0	1.00	10.0
16.0730	3.5	2.1	10.0	1.00	10.0
16.0830	3.5	2.1	10.0	0.95	10.0
16.0930	4.1	2.2	10.0	1.00	10.0
16.1030	4.1	2.7	9.5	1.00	7.9
16.1130	4.0	2.7	9.5	1.00	8.7
16.1230	4.1	2.7	9.2	1.00	8.7
16.1330	4.1	2.7	9.2	1.00	8.7
16.1430	3.4	2.0	9.1	1.00	8.7
16.1530	3.1	2.0	9.5	1.00	7.9
16.1630	3.2	2.0	9.3	1.00	8.7
16.1730	3.2	2.0	9.3	1.00	9.5
16.1830	3.4	2.2	9.3	1.00	9.2
16.1930	3.4	2.2	9.3	1.00	9.2
16.2030	3.7	2.2	9.3	1.00	9.2
16.2130	3.4	2.2	9.5	1.00	9.7
16.2230	3.1	2.0	9.2	1.00	7.9
16.2330	3.8	2.0	9.7	1.00	8.7
17.0030	3.8	1.5	10.0	0.98	8.7
17.0130	3.8	1.7	10.2	0.98	8.2
17.0230	3.8	2.0	10.2	1.00	9.2
17.0330	3.2	2.0	10.5	1.00	10.5
17.0430	3.5	2.0	10.2	1.00	8.1
17.0530	3.5	1.9	10.2	1.00	8.7
17.0630	3.5	1.9	10.0	1.00	8.7
17.0730	3.5	2.0	10.0	1.00	8.7
17.0830	3.9	2.1	10.1	1.00	8.7
17.0930	4.4	2.5	10.0	1.00	8.7
17.1030	4.4	2.2	9.7	1.00	8.7
17.1130	4.4	2.4	9.6	1.00	8.7
17.1230	4.1	2.4	9.8	1.00	8.7

APPENDIX F: TABLE III.
RUN 8: PRESSURES PAGE 10 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
17.1330	4.1	2.2	9.6	1.00	8.7
17.1430	4.2	2.2	10.0	1.00	8.7
17.1530	4.1	2.1	9.7	1.00	8.7
17.1630	4.1	2.1	10.3	1.00	8.7
17.1730	4.2	2.1	10.0	1.00	8.7
17.1830		MISSED DATA READING			
17.1930		MISSED DATA READING			
17.2030	4.5	2.0	9.3	1.00	8.7
17.2130	4.2	2.2	9.5	0.95	8.7
17.2230	3.9	2.0	9.6	1.00	8.7
17.2330	3.7	2.0	9.7	0.99	8.7
18.0030	3.9	1.9	9.6	0.99	8.8
18.0130	3.9	2.0	9.7	0.99	8.3
18.0230	3.9	2.0	10.0	0.99	8.7
18.0330	3.7	2.0	10.1	1.00	10.0
18.0430	3.7	2.0	10.0	0.99	9.2
18.0530	3.7	2.0	10.2	0.99	8.7
18.0630	3.4	2.0	10.5	0.99	8.7
18.0730	3.6	2.0	10.5	0.95	8.8
18.0830	3.7	2.0	10.5	0.85	8.7
18.0930	4.1	2.0	10.0	1.00	10.5
18.1030	4.4	2.0	10.2	1.00	10.0
18.1130	4.4	2.0	10.1	1.00	10.0
18.1230	4.4	2.0	10.1	1.00	8.7
18.1330	4.4	2.0	10.2	1.00	8.7
18.1430	4.4	2.0	10.2	1.00	8.7
18.1530	4.4	2.0	10.0	1.00	8.7
18.1630	4.4	2.0	9.5	1.00	8.7
18.1730	4.5	2.1	9.2	1.00	8.7
18.1830	4.9	2.2	9.1	1.00	8.7
18.1930	4.6	2.0	8.7	1.00	8.7
18.2030	4.6	2.0	8.7	1.00	8.7
18.2130	4.5	2.0	8.8	1.00	8.7
18.2230	4.2	2.0	9.0	1.00	8.7
18.2330	4.5	2.0	8.7	1.00	8.7
19.0030	4.6	1.9	8.7	1.00	8.7
19.0130	4.6	1.7	8.8	1.00	8.7
19.0230	4.6	2.0	9.2	1.00	7.6
19.0330	4.5	1.7	9.6	1.05	8.6
19.0430	4.5	1.7	9.7	1.00	8.7

APPENDIX F: TABLE F11.
RUN 8: PRESSURES PAGE 11 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
19.0530	4.6	1.7	10.0	1.00	8.7
19.0630	4.7	2.0	10.1	1.00	8.7
19.0730	4.7	2.0	10.1	1.05	8.7
19.0830	4.5	2.0	10.2	0.90	8.7
19.0930	4.5	2.1	10.5	1.00	10.0
19.1030	4.4	2.0	10.7	1.00	10.5
19.1130	4.0	2.0	10.7	1.00	10.0
19.1230	4.7	2.1	10.8	1.00	10.0
19.1330	4.6	2.0	10.7	1.00	9.5
19.1430	4.6	2.0	10.7	1.05	10.0
19.1530	4.5	2.0	11.1	1.05	10.5
19.1630	4.6	2.0	10.9	1.00	10.5
19.1730	5.2	2.2	10.9	1.05	10.5

SHUT DOWN AT 19.1730 FOR 36 HOURS

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
21.0630	2.5	2.4	9.6	1.00	11.2
21.0730	2.5	2.4	9.5	1.00	9.3
21.0830	2.5	2.4	9.5	1.00	9.0
21.0930	2.4	2.4	9.3	1.00	8.8
21.1030	2.4	2.4	9.2	1.00	9.0
21.1130	2.4	2.4	9.2	1.05	10.0
21.1230	2.4	2.4	9.3	1.05	8.7
21.1330	2.4	2.4	9.3	1.05	10.0
21.1430	2.4	2.4	9.5	1.05	8.8
21.1530	2.4	2.4	9.5	1.05	9.5
21.1630	2.4	2.4	9.3	1.05	8.8
21.1730	2.4	2.4	9.3	1.05	8.8
21.1830	2.4	2.5	9.3	1.05	9.8
21.1930	2.5	2.4	9.3	1.00	9.5
21.2030	2.6	2.5	9.5	1.00	8.7
21.2130	2.6	2.6	9.5	1.00	8.5
21.2230	2.6	2.7	9.5	1.00	8.2
21.2330	2.7	2.7	9.5	1.00	8.2
22.0030	3.0	3.0	9.5	1.00	8.2
22.0130	3.0	3.0	9.5	1.00	8.2
22.0230	3.0	3.0	9.3	1.00	8.5
22.0330	3.0	2.9	9.3	1.00	8.5
22.0430	3.0	2.9	9.3	1.00	8.5

APPENDIX F: TABLE III.
RUN 8: PRESSURES PAGE 12 OF 12

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
22.0530	3.0	3.0	9.3	1.00	0.5
22.0630	3.0	2.9	9.2	1.00	0.5
22.0730	3.0	2.9	9.3	1.00	0.7
22.0830	3.0	3.0	9.3	1.00	0.7
22.0930	2.6	3.0	9.3	1.00	0.7
22.1030	2.5	2.7	9.2	1.00	0.7
22.1130	2.5	2.7	9.2	1.05	0.7
22.1230	2.5	2.7	9.2	1.05	0.7
22.1330	2.6	2.7	[illegible]	1.00	0.
22.1430	3.1	2.7	9.2	1.00	0.
22.1530	MISSED DATA READING				
22.1630	2.5	2.6	9.2	1.00	0.

APPENDIX F: TABLE IV.

RUN 8: DESULPHURISATION PERFORMANCE PAGE 1 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
1.0330	60.4	1.45	54.	20.7	0.83	19.8	19.8
1.0430	71.6	1.51	57.	21.6	1.87	42.8	44.9
1.0530	77.6	1.48	59.	22.3	2.36	52.4	49.5
1.0630	79.3	1.53	65.	23.8	2.25	56.7	58.4
1.0730	81.2	1.56	64.	23.3	2.19	53.1	59.9
1.0830	82.3	1.70	66.	25.5	2.08	48.7	61.7
1.0930	80.9	1.65	66.	24.7	2.07	40.3	48.7
1.1030	81.7	1.67	74.	25.3	2.05	42.8	35.2
1.1130	84.6	1.67	75.	25.8	2.95	32.8	29.8
1.1230	85.2	1.68	80.	25.4	2.62	36.7	32.2
1.1330	85.3	1.87	77.	27.2	3.32	32.1	38.4
1.1430	86.5	1.87	82.	27.5	2.62	32.1	40.4
1.1530	86.5	1.64	81.	27.5	2.59	31.2	37.8
1.1630	87.4	1.79	81.	27.8	3.16	28.2	28.6
1.1730	87.8	1.79	87.	28.5	3.08	29.4	28.1
1.1830	87.9	1.78	91.	26.7	3.48	25.6	38.5
1.1930	88.3	1.72	91.	27.4	3.84	59.2	62.9
1.2030	87.9	1.60	93.	27.4	2.65	62.2	54.4
1.2130	87.9	1.70	93.	27.8	2.67	76.8	68.5
1.2230	87.8	1.75	93.	27.8	2.26	89.9	83.4
1.2330	87.7	1.73	93.	27.2	3.22	82.9	88.7
2.0030	88.2	1.65	95.	26.1	2.89	85.1	99.8
2.0130	88.1	1.73	93.	27.3	2.43	95.8	108.3
2.0230	87.5	1.56	93.	26.1	2.02	95.8	120.2
2.0330	89.1	1.55	98.	25.7	3.42	86.1	117.4
2.0430	88.9	1.58	95.	26.4	4.43	105.9	118.4
2.0530	88.6	1.54	97.	26.5	3.66	104.5	112.3
2.0630	89.1	1.53	96.	26.4	2.88	64.7	98.9
2.0730	89.4	1.61	103.	27.4	2.64	86.5	93.2
2.0830	89.3	1.64	99.	27.3	2.19	87.3	107.4
2.0930	89.4	1.62	99.	26.9	2.54	89.7	121.8
2.1030	89.9	1.59	98.	26.6	2.35	101.8	105.8
2.1130	89.6	1.64	100.	26.9	3.82	66.5	66.7
2.1230	89.8	1.72	101.	27.2	2.53	70.8	73.7
2.1330	89.4	1.73	93.	26.9	1.69	69.9	68.2
2.1430	88.2	1.78	97.	28.8	2.03	59.2	65.4
2.1530	88.3	1.78	87.	27.9	3.02	58.1	66.1
2.1630	85.5	1.73	98.	28.1	2.88	58.1	71.1
2.1730	83.6	1.78	99.	28.1	2.71	41.1	52.6
2.1830	82.3	1.75	86.	27.6	2.36	46.6	68.6

APPENDIX F: TABLE IV.
RUN 8: DESULPHURISATION PERFORMANCE PAGE 2 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
2.1930	79.8	1.75	87.	27.5	2.37	51.1	78.7
2.2030	81.6	1.93	88.	26.1	1.37	55.5	75.8
2.2130	84.8	1.89	91.	27.2	1.64	55.8	68.9
2.2230	83.7	1.98	89.	29.7	4.98	42.6	51.5
2.2330	81.5	1.89	89.	29.5	5.32	39.8	49.8
3.0030	82.6	2.08	82.	28.4	2.16	43.5	56.6
3.0130	82.7	1.96	82.	26.4	1.13	37.8	46.3
3.0230	81.3	2.00	88.	25.6	1.68	34.9	39.9
3.0330	82.4	2.43	78.	26.9	1.55	54.1	58.8
3.0430	78.3	2.51	78.	26.3	1.22	47.1	48.7
3.0530	74.3	2.51	77.	26.4	1.89	47.1	49.1
3.0630	71.9	2.59	71.	26.4	1.89	56.8	68.6
3.0730	68.4	2.70	77.	26.4	0.73	48.7	54.5
3.0830	64.2	2.65	78.	25.8	0.63	65.4	88.8
3.0930	54.4	2.48	64.	24.2	0.88	50.2	78.9
3.1030	57.6	1.81	62.	20.8	0.99	56.5	75.6
3.1130	60.9	1.89	58.	22.7	0.69	56.9	72.7
3.1230	67.8	1.83	62.	22.9	1.81	53.9	72.4
3.1330	70.6	1.81	61.	24.8	1.99	53.2	69.9
3.1430	75.2	1.84	67.	24.3	2.84	57.3	69.4
3.1530	77.6	1.83	68.	25.5	2.49	59.2	68.5
3.1630	78.4	1.80	73.	25.6	2.88	51.4	59.1
3.1730	79.6	1.87	74.	27.4	2.31	52.2	72.4
3.1830	76.7	1.89	76.	24.3	2.26	50.8	67.6
3.1930	76.6	1.87	74.	26.5	3.38	59.4	66.3
3.2030	77.7	1.81	77.	26.5	3.13	57.5	72.1
3.2130	79.1	1.83	77.	25.6	3.31	56.8	66.6
3.2230	77.5	1.84	81.	25.8	2.64	61.8	75.4
3.2330	80.2	1.70	78.	25.4	3.46	56.8	73.3
4.0030	83.4	1.68	80.	24.6	0.61	54.5	81.6
4.0130	85.1	1.68	81.	24.6	2.65	64.6	81.8
4.0230	84.7	1.73	82.	25.5	2.19	57.9	67.7
4.0330	83.5	1.72	82.	25.5	1.98	55.8	65.7
4.0430	84.8	1.78	89.	25.9	3.06	50.8	69.3
4.0530	86.4	1.74	98.	26.7	3.73	47.2	55.8
4.0630	86.5	1.78	97.	26.7	1.49	46.6	54.4
4.0730	84.9	1.76	93.	26.2	1.86	62.8	75.2
4.0830	82.9	1.75	87.	27.2	1.78	63.8	78.8
4.0930	83.4	1.75	88.	26.4	2.18	63.4	78.2
4.1030	83.4	1.75	86.	26.8	0.88	62.6	78.4

APPENDIX F: TABLE IV.

RUN 6: DESULPHURISATION PERFORMANCE PAGE 3 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FRD
4.1130	81.9	1.75	83.	26.6	0.71	63.8	83.9
4.1230	79.5	1.76	82.	26.4	0.62	60.8	88.6
4.1330	79.0	1.73	85.	26.6	1.05	64.9	90.9
4.1430	78.7	1.73	85.	25.8	1.30	63.7	86.4
4.1530	78.7	1.72	84.	26.2	1.29	55.0	73.1
4.1630	79.0	1.72	82.	25.6	1.16	61.5	78.7
4.1730	78.3	1.68	78.	26.0	1.30	61.5	80.3
4.1830	79.1	1.70	80.	25.2	1.50	70.3	78.0
4.1930	79.8	1.68	80.	25.6	1.45	75.6	81.2
4.2030	80.0	1.68	77.	25.5	1.28	83.0	84.7
4.2130	81.0	1.70	78.	25.8	1.45	70.8	81.1
4.2230	80.6	1.64	76.	24.5	1.30	74.6	78.7
4.2330	81.7	1.70	83.	24.5	1.07	61.5	86.9
5.0030	82.0	1.72	84.	24.4	1.15	68.5	75.7
5.0130	82.6	1.72	84.	24.5	1.32	68.3	72.9
5.0230	82.7	1.70	85.	24.5	1.23	69.9	69.5
5.0330	82.1	1.72	82.	24.8	0.90	70.9	93.9
5.0430	82.7	1.64	107.	24.4	1.15	71.4	78.4
5.0530	82.8	1.62	107.	24.6	1.32	71.8	75.1
5.0630	83.1	1.65	107.	24.4	1.23	68.6	80.3
5.0730	82.7	1.65	105.	24.4	0.91	72.4	74.8
5.0830	82.5	1.59	96.	24.3	1.03	76.4	79.6
5.0930	MISSED DATA READING						
5.1030	MISSED DATA READING						
5.1130	77.1	1.67	96.	24.4	0.45	66.8	78.2
5.1230	78.0	1.69	91.	25.2	1.05	61.6	76.5
5.1330	76.3	1.67	91.	25.5	0.86	59.1	75.7
5.1430	76.5	1.67	91.	25.4	0.74	65.7	80.6
5.1530	77.5	1.54	91.	24.2	0.61	64.7	83.8
5.1630	77.7	1.53	91.	23.8	0.94	63.2	78.3
5.1730	78.0	1.58	91.	23.8	1.08	66.9	78.4
5.1830	78.3	1.58	95.	23.9	0.95	62.5	76.3
5.1930	79.9	1.59	95.	25.3	0.79	55.8	75.9
5.2030	77.4	1.78	95.	26.5	0.66	52.0	76.6
5.2130	76.1	1.73	93.	26.4	0.62	49.5	75.3
5.2230	75.5	1.70	93.	26.2	0.93	51.4	77.4
5.2330	78.1	1.65	107.	26.2	1.11	48.7	72.9
6.0030	78.6	1.65	99.	26.2	1.02	49.2	72.7
6.0130	79.3	1.65	99.	26.3	1.07	50.3	71.1
6.0230	78.7	1.72	96.	26.3	0.50	50.6	72.1

APPENDIX F: TABLE IV.
RUN 8: DESULPHURISATION PERFORMANCE PAGE 4 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
6.0330	76.8	1.76	100.	25.8	0.88	45.6	64.4
6.0430	76.2	1.72	102.	25.8	2.03	40.6	65.3
6.0530	79.0	1.73	99.	25.7	0.57	45.3	63.6
6.0630	78.4	1.75	100.	25.7	1.15	40.7	63.6
6.0730	78.4	1.75	101.	25.8	1.18	51.3	67.5
6.0830	77.9	1.74	101.	25.9	1.24	58.6	77.5
6.0930	77.8	1.72	99.	25.3	1.37	69.3	77.2
6.1030	77.3	1.64	93.	25.1	0.44	68.6	72.2
6.1130	77.7	1.62	99.	24.9	1.09	78.9	77.0
6.1230	79.3	1.63	99.	24.5	1.13	75.5	72.5
6.1330	79.3	1.56	99.	23.2	1.02	69.4	65.5
6.1430	79.4	1.59	99.	25.7	0.91	80.7	75.0
6.1530	79.7	1.61	94.	24.7	0.75	77.3	71.2
6.1630	79.6	1.62	98.	24.8	1.06	73.3	72.6
6.1730	78.3	1.67	85.	24.7	1.13	64.2	69.1
6.1830	78.4	1.61	93.	24.6	0.40	67.8	70.7
6.1930	78.4	1.61	93.	24.8	0.84	66.8	78.9
6.2030	77.5	1.59	96.	24.8	1.00	76.2	79.3
6.2130	78.1	1.59	95.	24.7	0.97	43.9	47.4
6.2230	78.9	1.59	96.	24.7	0.96	77.8	79.3
6.2330	79.4	1.59	96.	24.8	1.45	79.8	78.8
7.0030	79.5	1.59	87.	25.8	1.50	72.5	78.4
7.0130	80.3	1.61	96.	25.8	1.32	67.9	76.5
7.0230	81.2	1.61	96.	24.8	1.58	65.8	73.1
7.0330	82.2	1.59	107.	24.9	1.54	64.8	78.3
7.0430	81.8	1.58	107.	25.8	1.32	78.2	71.7
7.0530	82.6	1.59	107.	25.8	1.06	57.1	62.5
7.0630	82.8	1.59	95.	25.8	1.85	74.5	75.4
7.0730	82.1	1.61	96.	24.9	1.06	61.9	77.2
7.0830	81.7	1.62	92.	24.8	1.18	71.3	76.6
7.0930	79.7	1.64	92.	24.9	1.23	65.4	82.6
7.1030	77.2	1.58	92.	23.2	1.19	89.4	74.8
7.1130	78.1	1.62	98.	23.7	1.50	54.9	67.3
7.1230	78.5	1.62	98.	24.2	0.94	56.8	69.1
7.1330	79.1	1.58	92.	22.1	0.73	64.6	78.3
7.1430	79.9	1.56	91.	22.6	0.75	61.3	64.6
7.1530	79.9	1.50	91.	22.4	1.06	56.7	66.5
7.1630	76.7	1.67	91.	22.4	1.10	58.5	72.9
7.1730	71.2	1.54	92.	24.7	1.32	51.8	68.8
7.1830	68.5	1.48	97.	24.6	1.58	49.8	66.3

APPENDIX B TABLE IV.
RUN 8: DESULPHURISATION PERFORMANCE PAGE 5 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	O-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
7.1930	63.8	1.29	99.	22.7	1.36	46.3	64.0
7.2030	74.5	1.33	101.	23.4	1.15	46.7	63.7
7.2130	74.0	1.22	105.	23.0	1.23	47.5	64.6
7.2230	73.6	1.22	109.	22.8	0.84	49.8	64.4
7.2330	72.6	1.26	106.	22.7	1.01	47.4	64.4
8.0030	66.8	1.64	93.	24.1	1.24	36.2	43.6
8.0130	72.2	1.68	97.	24.6	1.17	46.9	56.3
8.0230	76.5	1.67	93.	23.3	1.15	46.7	55.8
8.0330	75.9	1.67	95.	24.5	1.17	49.5	57.9
8.0430	76.7	1.67	95.	24.0	1.23	51.0	57.8
8.0530	76.0	1.68	95.	24.1	1.23	54.3	65.3
8.0630	76.7	1.68	95.	23.3	1.09	48.5	57.8
8.0730	75.9	1.65	95.	23.1	0.94	52.5	62.7
8.0830	71.4	1.68	110.	23.4	0.93	50.4	58.2
8.0930	70.8	1.70	95.	23.3	0.57	50.4	57.2
8.1030	70.4	1.75	99.	23.9	0.36	60.9	68.0
8.1130	70.1	1.76	95.	24.1	0.84	57.7	66.9
8.1230	70.0	1.72	91.	23.8	0.48	52.6	62.3
8.1330	65.8	1.73	89.	23.8	0.57	51.2	62.5
8.1430	68.6	0.89	91.	23.8	0.75	52.0	66.4
8.1530	67.1	0.89	91.	23.0	0.18	52.0	66.7
8.1630	65.4	1.73	93.	23.9	0.10	48.8	61.3
8.1730	69.7	1.76	93.	23.9	0.97	45.1	54.8
8.1830	71.4	1.72	91.	24.0	0.93	54.5	64.1
8.1930	69.9	1.93	82.	24.2	0.93	42.6	62.8
8.2030	64.7	1.98	78.	24.2	1.10	42.2	60.1
8.2130	62.8	1.86	77.	24.1	1.06	38.9	54.3
8.2230	63.5	1.79	80.	23.6	1.15	39.5	57.3
8.2330	58.8	1.83	78.	23.6	0.88	44.2	49.9
9.0030	61.8	1.83	76.	23.7	0.75	46.2	57.5
9.0130	61.4	1.73	76.	23.1	0.75	42.0	52.1
9.0230	62.1	1.76	76.	23.7	0.75	42.1	52.2
9.0330	61.3	1.78	76.	23.1	0.40	42.4	52.8
9.0430	63.9	1.79	80.	22.9	1.46	47.5	57.0
9.0530	65.5	1.72	77.	22.8	0.97	45.7	57.5
9.0630	66.6	1.78	77.	22.9	1.02	44.1	52.8
9.0730	68.2	1.78	78.	23.3	1.02	49.6	59.8
9.0830	69.5	1.78	78.	23.3	1.41	46.5	55.3
9.0930	68.1	1.78	80.	23.2	0.53	47.8	57.7
9.1030	67.9	1.73	79.	23.3	0.84	53.5	65.2

APPENDIX 8: TABLE IV.
RUN 8: DESULPHURISATION PERFORMANCE PAGE 6 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
9.1130	64.7	1.72	76.	23.2	0.26	52.6	61.8
9.1230	60.6	1.60	60.	22.6	0.62	45.5	54.7
9.1330	61.8	1.70	64.	22.6	1.10	42.1	53.0
9.1430	61.2	1.69	61.	22.5	0.96	44.2	50.6
9.1530	61.8	1.64	54.	22.2	1.51	40.5	45.2
9.1630	59.8	1.65	54.	22.1	1.26	42.0	51.1
9.1730	59.7	1.65	54.	22.1	0.49	48.1	51.1
9.1830	56.4	1.61	53.	21.5	1.19	41.5	42.3
9.1930	62.9	1.51	58.	20.8	1.46	50.3	54.6
9.2030	63.1	1.54	55.	21.4	1.10	44.1	46.8
9.2130	61.9	1.47	57.	20.2	0.88	43.5	49.3
9.2230	63.3	1.44	58.	20.3	0.89	45.2	47.9

SHUT DOWN AT 9.2230 FOR 23 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
10.2230	-	1.90	69.	24.4	1.43	3.0	2.8
10.2330	75.1	1.86	73.	25.0	1.19	32.1	31.6
11.0030	73.4	1.78	73.	23.7	1.25	43.4	42.2
11.0130	73.4	1.76	76.	23.3	1.55	44.2	40.9
11.0230	76.8	1.76	77.	23.1	1.50	46.8	40.3
11.0330	78.0	1.76	78.	23.9	1.00	65.0	61.2
11.0430	76.3	1.78	77.	23.9	0.77	69.1	68.1
11.0530	75.8	1.93	76.	23.9	0.72	66.6	65.7
11.0630	74.8	1.79	76.	22.9	0.87	67.5	67.3
11.0730	71.0	1.93	76.	30.5	1.16	68.3	68.0

SHUT DOWN AT 11.0730 FOR 19 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
12.0330	-	1.75	73.	27.5	1.02	-	0.
12.0430	-	1.87	71.	25.3	1.19	-	0.
12.0530	-	1.66	71.	25.3	1.51	-	0.
12.0630	-	2.01	71.	27.2	1.17	-	0.
12.0730	-	1.70	71.	24.4	0.70	10.3	21.5
12.0830	14.8	1.70	69.	23.8	0.82	6.1	7.2
12.0930	14.7	1.83	71.	25.6	1.16	11.2	12.1
12.1030	23.7	1.75	60.	25.4	1.24	-	0.
12.1130	36.3	1.72	76.	25.0	0.65	-	0.
12.1230	38.9	1.65	69.	24.0	1.54	13.0	14.3

APPENDIX E: TABLE IV.

RUN 8: DESULPHURISATION PERFORMANCE PAGE 7 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
12.1330	40.0	1.65	78.	23.9	1.32	13.1	14.6
12.1430	41.1	1.72	81.	24.2	2.10	-	0.
12.1530	22.2	1.72	81.	23.9	2.25	-	0.
12.1630	30.6	1.60	86.	24.1	1.98	23.5	25.4
12.1730	32.9	1.50	86.	19.8	1.83	29.7	28.4
12.1830	58.6	1.48	86.	20.9	1.76	10.2	10.8
12.1930	72.5	1.51	88.	22.1	2.33	40.7	44.8
12.2030	76.8	1.50	88.	22.1	1.74	50.8	48.3
12.2130	78.3	1.51	92.	22.2	2.21	57.0	50.1
12.2230	79.2	1.50	88.	22.2	1.62	64.2	56.5
12.2330	80.2	1.50	88.	22.2	1.23	72.7	56.7
13.0030	81.0	1.58	88.	22.7	1.20	75.6	64.0
13.0130	81.8	1.50	88.	23.2	1.62	58.1	72.1
13.0230	81.6	1.54	90.	22.3	1.78	53.4	61.3
13.0330	77.0	1.48	91.	22.7	1.39	40.7	50.3
13.0430	66.2	1.57	88.	20.4	1.43	43.1	54.5
13.0530	63.1	1.50	88.	20.8	1.40	45.3	54.9
13.0630	61.8	1.51	88.	20.9	1.46	42.0	57.6
13.0730	61.1	1.51	88.	20.4	1.35	55.5	71.5
13.0830	59.4	1.51	87.	20.5	1.86	50.4	64.1
13.0930	58.1	1.51	87.	20.4	0.66	40.9	50.1
13.1030	58.0	1.51	90.	20.2	1.63	38.6	46.5
13.1130	60.6	1.51	93.	20.6	2.03	44.4	54.0
13.1230	59.1	1.59	88.	21.3	1.82	40.1	47.9
13.1330	59.0	1.59	88.	21.4	2.00	28.8	32.9
13.1430	61.1	1.56	88.	21.3	1.17	35.4	42.7
13.1530	60.0	1.56	88.	21.2	1.67	30.0	40.0
13.1630	61.1	1.62	90.	22.3	1.79	37.5	43.7
13.1730	63.1	1.61	90.	22.2	1.98	34.5	30.9
13.1830	64.1	1.62	88.	22.1	1.71	30.9	47.2
13.1930	64.8	1.62	88.	22.3	1.57	41.6	40.8
13.2030	65.5	1.59	88.	22.3	2.12	39.9	47.5
13.2130	66.1	1.61	88.	22.5	1.69	43.1	51.4
13.2230	66.7	1.61	90.	22.3	1.83	40.4	47.4
13.2330	67.5	1.64	90.	22.3	1.86	30.0	45.7
14.0030	70.5	1.53	90.	20.3	1.53	51.7	40.3
14.0130	75.0	1.53	90.	21.3	1.53	54.7	54.9
14.0230	78.4	1.51	90.	21.3	1.64	54.7	54.9
14.0330	79.5	1.53	90.	22.0	2.07	50.7	54.7
14.0430	79.9	1.53	94.	21.9	1.08	57.8	56.0

APPENDIX E1 TABLE IV.

RUN 86 DESULPHURISATION PERFORMANCE PAGE 8 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	0-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
14.0530	80.8	1.54	90.	21.8	1.54	61.9	59.6
14.0630	80.5	1.58	88.	22.2	1.46	60.9	59.7
14.0730	80.1	1.58	88.	22.3	1.50	61.7	60.8
14.0830	79.6	1.58	82.	22.4	1.44	63.2	59.3
14.0930	79.6	1.51	90.	21.5	1.33	68.2	61.8
14.1030	79.4	1.48	92.	21.4	1.50	70.8	61.2
14.1130	79.5	1.48	88.	21.5	1.87	68.1	60.3
14.1230	79.2	1.48	88.	21.4	1.68	67.2	61.3
14.1330	78.6	1.48	88.	21.5	1.80	67.7	62.1
14.1430	78.9	1.48	88.	21.6	1.42	70.9	64.1
14.1530	80.0	1.48	91.	21.6	1.81	66.5	62.1
14.1630	77.9	1.48	91.	21.9	1.94	65.8	61.8
14.1730	77.2	1.54	91.	22.4	1.83	65.9	64.6
14.1830	78.7	1.58	91.	22.5	1.76	60.4	62.7
14.1930	78.9	1.58	91.	22.5	1.61	64.8	68.1
14.2030	78.3	1.59	91.	22.6	1.79	64.1	73.7
14.2130	77.3	1.59	88.	22.5	1.83	61.8	70.5
14.2230	78.6	1.54	88.	22.1	1.94	60.9	69.7
14.2330	78.1	1.51	87.	21.4	1.88	60.9	67.5
15.0030	78.3	1.54	87.	21.8	1.80	61.4	67.8
15.0130	79.6	1.58	86.	22.2	2.05	59.0	70.0
15.0230	80.4	1.58	83.	22.5	1.49	58.6	73.6
15.0330	82.2	1.59	88.	22.3	2.09	55.1	68.9
15.0430	81.9	1.59	88.	22.4	2.02	52.0	64.7
15.0530	81.7	1.58	86.	22.2	1.84	54.4	68.8
15.0630	82.0	1.58	87.	22.1	1.21	54.0	68.3
15.0730	82.1	1.51	87.	21.3	1.78	52.8	66.7
15.0830	80.9	1.59	86.	22.2	1.67	45.1	55.8
15.0930	77.7	1.59	88.	22.2	1.15	54.1	63.6
15.1030	76.9	1.58	88.	22.1	1.06	55.3	63.9
15.1130	75.3	1.58	88.	21.3	1.47	56.3	60.7
15.1230	75.7	1.51	89.	21.3	1.99	57.9	61.5
15.1330	76.2	1.51	98.	21.2	1.68	52.8	59.1
15.1430	76.2	1.51	100.	21.4	1.37	55.9	57.2
15.1530	77.3	1.58	96.	21.3	1.05	57.5	54.7
15.1630	78.5	1.58	99.	21.8	1.91	54.7	58.9
15.1730	79.5	1.58	101.	22.1	2.22	64.4	56.7
15.1830	81.2	1.50	100.	22.2	1.74	59.5	57.8
15.1930	81.6	1.50	104.	23.3	1.79	58.6	57.6
15.2030	82.2	1.58	102.	23.3	1.61	60.7	63.4

APPENDIX E: TABLE IV.
RUN 8: DESULPHURISATION PERFORMANCE PAGE 9 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
15.2130	82.7	1.59	103.	23.3	1.68	68.8	45.8
15.2230	81.0	1.58	104.	22.4	1.83	53.5	50.9
15.2330	86.7	1.58	107.	23.3	1.30	55.6	61.8
16.0030	88.6	1.80	105.	23.3	1.20	56.2	63.7
16.0130	89.2	1.59	103.	22.2	2.14	55.2	62.4
16.0230	77.8	1.59	99.	22.5	1.07	56.3	62.6
16.0330	79.8	1.58	101.	22.7	2.07	63.5	65.6
16.0430	88.3	1.59	100.	23.0	1.62	62.3	58.3
16.0530	79.2	1.54	101.	21.1	1.66	101.8	67.3
16.0630	68.5	1.56	101.	21.1	1.42	-	0.
16.0730	73.6	1.56	101.	20.8	1.21	-	0.
16.0830	73.5	1.61	106.	22.6	1.53	-	0.
16.0930	88.4	1.62	101.	23.0	1.11	88.2	30.7
16.1030	81.3	1.92	96.	24.4	1.65	79.4	77.6
16.1130	77.9	1.90	96.	24.4	1.28	65.3	78.5
16.1230	77.5	1.89	93.	23.2	1.57	65.5	74.5
16.1330	79.7	1.83	93.	23.7	1.48	66.6	69.5
16.1430	88.2	1.49	95.	21.0	1.65	106.5	71.0
16.1530	83.1	1.49	96.	20.8	1.46	89.1	87.5
16.1630	86.4	1.59	95.	32.9	1.96	74.7	133.7
16.1730	84.6	1.59	95.	26.5	0.83	73.6	96.9
16.1830	82.5	1.59	95.	25.7	1.25	60.5	91.7
16.1930	83.6	1.59	95.	24.8	1.60	64.8	75.0
16.2030	81.8	1.56	95.	23.7	1.38	56.9	67.0
16.2130	88.4	1.54	96.	22.8	1.15	77.2	69.1
16.2230	89.8	1.37	93.	20.5	1.36	82.5	53.6
16.2330	79.1	1.34	90.	20.7	2.24	10.1	7.4
17.0030	78.8	1.36	112.	20.9	2.08	-	0.
17.0130	79.3	1.34	115.	20.9	2.29	-	0.
17.0230	79.9	1.44	104.	21.0	1.76	-	0.
17.0330	81.1	1.37	106.	20.9	2.14	-	0.
17.0430	82.4	1.37	104.	20.0	1.39	-	0.
17.0530	83.4	1.31	104.	19.9	1.58	-	0.
17.0630	83.4	1.21	101.	19.9	1.65	-	0.
17.0730	82.1	1.39	101.	20.9	1.10	-	0.
17.0830	86.5	1.40	102.	22.1	1.39	-	0.
17.0930	87.9	1.47	101.	23.2	1.78	-	0.
17.1030	88.6	1.64	99.	24.7	1.49	-	0.
17.1130	89.9	1.64	97.	25.1	1.51	33.0	20.3
17.1230	92.4	1.59	100.	25.7	1.69	93.4	114.7

APPENDIX B. TABLE IV.

RUN 81 DESULPHURISATION PERFORMANCE PAGE 10 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
17:1330	92.1	1.50	97.	24.6	2.17	98.5	106.8
17:1430	90.2	1.54	101.	23.8	1.56	100.2	111.8
17:1530	90.8	1.50	99.	26.3	1.61	98.1	108.2
17:1630	89.9	1.44	101.	25.3	2.03	88.5	104.9
17:1730	89.7	1.47	101.	25.4	2.72	98.8	110.6
17:1830	MISSED DATA READING						
17:1930	MISSED DATA READING						
17:2030	89.4	1.45	95.	23.2	1.19	88.4	96.2
17:2130	89.4	1.44	101.	22.3	1.64	110.7	79.2
17:2230	88.2	1.53	97.	24.9	1.32	113.4	77.8
17:2330	87.5	1.45	110.	24.9	2.48	85.7	84.5
18:0030	88.6	1.45	108.	24.8	1.77	92.6	89.1
18:0130	85.9	1.47	110.	24.7	1.57	73.6	85.5
18:0230	85.3	1.45	112.	24.9	1.80	81.9	84.2
18:0330	85.8	1.47	102.	23.9	1.35	85.2	80.0
18:0430	84.8	1.44	112.	24.8	1.31	89.1	78.9
18:0530	86.8	1.44	115.	24.5	2.42	38.4	27.6
18:0630	86.9	1.40	118.	24.8	1.23	91.8	73.3
18:0730	86.9	1.45	112.	24.9	1.61	106.1	80.9
18:0830	87.8	1.45	125.	24.8	2.03	84.3	91.6
18:0930	88.6	1.35	101.	24.8	1.82	89.3	121.2
18:1030	87.6	1.40	104.	24.2	1.40	88.2	98.6
18:1130	85.5	1.44	102.	23.8	1.54	107.5	73.4
18:1230	85.9	1.45	102.	23.8	1.95	71.9	39.9
18:1330	85.7	1.39	104.	24.1	1.59	108.8	82.7
18:1430	87.9	1.39	104.	24.5	1.75	85.3	86.9
18:1530	87.9	1.40	101.	24.4	1.61	71.2	88.8
18:1630	88.7	1.39	96.	23.7	1.40	63.9	83.4
18:1730	87.3	1.47	93.	23.9	1.67	68.2	79.8
18:1830	86.1	1.48	93.	24.8	1.76	67.9	87.9
18:1930	85.3	1.44	88.	24.4	1.87	56.9	73.1
18:2030	84.8	1.45	88.	24.5	2.29	70.8	81.2
18:2130	85.6	1.42	90.	24.9	2.28	75.8	80.1
18:2230	86.6	1.57	91.	34.3	2.26	75.7	78.8
18:2330	85.8	1.44	88.	24.8	1.90	17.8	76.5
19:0030	86.2	1.44	88.	24.7	2.31	98.5	69.8
19:0130	86.8	1.45	90.	24.7	1.80	64.6	77.1
19:0230	86.4	1.44	93.	24.8	2.41	65.9	73.8
19:0330	87.8	1.44	93.	24.7	2.44	91.3	73.4
19:0430	88.8	1.42	90.	22.8	2.95	85.2	68.5

APPENDIX 21 TABLE 14

RUN 8: DESULPHURISATION PERFORMANCE PAGE 11 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	O-BED DEPTH CENTIM	AIR/FUEL % WT.	CA/S RATIO MOL.	% CAS TO CAO	REGEN. % OUT % OF FED
19.0530	87.0	1.45	101.	25.3	1.80	87.8	63.5
19.0630	87.3	1.45	102.	25.7	1.96	81.7	65.2
19.0730	89.8	1.37	97.	24.3	1.99	66.6	66.8
19.0830	89.6	1.44	115.	25.6	1.61	67.8	68.8
19.0930	89.4	1.40	108.	24.6	0.26	83.3	55.5
19.1030	89.7	1.42	109.	24.7	0.42	76.4	63.4
19.1130	91.2	1.37	109.	24.7	0.56	100.6	88.6
19.1230	90.2	1.44	110.	25.7	0.80	92.3	82.4
19.1330	88.8	1.33	109.	23.2	1.31	88.7	57.6
19.1430	88.7	1.46	104.	22.4	1.05	14.1	8.8
19.1530	88.3	1.50	107.	22.4	0.96	14.1	8.8
19.1630	88.6	1.30	111.	21.1	0.78	7.1	4.4
19.1730	86.8	1.73	106.	27.7	0.75	46.3	29.6

SHUT DOWN AT 19.1730 FOR 36 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	O-BED DEPTH CENTIM	AIR/FUEL % WT.	CA/S RATIO MOL.	% CAS TO CAO	REGEN. % OUT % OF FED
21.0630	27.2	1.45	97.	22.7	1.90	36.8	42.2
21.0730	67.8	1.44	96.	22.8	0.93	61.2	85.2
21.0830	74.4	1.44	96.	22.9	0.98	[illegible]	83.8
21.0930	74.1	1.40	95.	22.1	0.88	78.7	86.6
21.1030	72.9	1.40	93.	22.5	0.92	74.6	87.3
21.1130	71.7	1.39	89.	21.6	1.35	82.3	83.5
21.1230	70.4	1.44	90.	21.6	1.16	99.8	87.2
21.1330	74.1	1.50	90.	22.6	0.81	98.7	83.5
21.1430	72.9	1.42	91.	21.5	0.81	107.4	76.3
21.1530	73.6	1.51	91.	22.9	1.04	91.7	64.8
21.1630	74.6	1.50	90.	22.7	1.16	104.4	70.7
21.1730	74.3	1.51	90.	22.6	1.15	102.5	73.6
21.1830	74.4	1.44	90.	21.8	1.04	100.2	71.6
21.1930	74.5	1.44	95.	21.6	1.31	90.6	66.8
21.2030	74.3	1.59	96.	24.7	1.41	70.5	58.8
21.2130	75.6	1.58	95.	25.1	1.02	85.9	82.9
21.2230	70.6	1.56	96.	24.4	1.04	79.2	81.4
21.2330	76.5	1.56	96.	23.7	1.16	84.4	101.9
22.0030	77.8	1.56	96.	23.8	1.50	79.9	88.8
22.0130	77.2	1.56	96.	23.8	1.56	67.1	88.3
22.0230	76.4	1.58	95.	23.2	1.35	63.2	79.5
22.0330	76.9	1.56	95.	22.9	1.26	60.5	74.3
22.0430	77.9	1.58	93.	22.9	1.04	58.2	68.7

APPENDIX E: TABLE IV.
RUN 8: DESULPHURISATION PERFORMANCE PAGE 12 OF 12

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
22.0530	76.8	1.56	95.	22.9	1.08	53.5	68.9
22.0630	76.8	1.56	93.	22.9	1.22	64.6	69.2
22.0730	76.3	1.55	95.	22.7	1.15	59.6	78.0
22.0830	75.6	1.56	95.	22.9	0.89	78.7	77.6
22.0930	73.6	1.54	95.	22.9	0.63	63.1	72.9
22.1030	71.6	1.54	93.	23.1	1.11	65.6	75.4
22.1130	72.7	1.56	89.	23.3	1.42	52.5	57.4
22.1230	74.0	1.48	89.	21.2	1.34	59.3	69.7
22.1330	76.3	1.47	93.	22.2	1.26	53.4	68.8
22.1430	75.1	1.48	93.	22.2	1.38	66.7	71.1
22.1530	MISSED DATA READING						
22.1630	*	1.47	93.	22.1	0.97	55.3	67.4

APPENDIX 7: TABLE 6.

RUN 8: GAS COMPOSITIONS PAGE 1 OF 4

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
1-0330	5.1	14.0	11.9	303.	0.50	4.4	1.0	16.4	17.7	3.10	2.82
1-0430	5.1	14.0	11.9	347.	0.90	3.0	4.0	16.7	17.0	2.86	2.78
1-0530	4.5	14.0	12.3	283.	0.50	2.7	5.4	17.7	18.0	2.00	1.97
1-0630	4.4	14.0	12.4	263.	0.50	2.5	6.2	17.0	18.0	2.10	1.83
1-0730	3.5	14.0	13.0	253.	0.50	3.8	5.9	17.0	18.0	2.10	1.79
1-0830	1.5	12.2	14.5	263.	0.50	1.7	5.6	17.3	18.7	2.12	1.43
1-0930	1.6	12.2	14.5	283.	0.50	3.1	4.6	17.3	18.7	2.12	1.46
1-1030	1.7	12.2	14.4	273.	0.30	7.1	3.1	17.5	18.7	2.04	1.43
1-1130	1.4	12.2	14.6	233.	0.30	3.7	3.1	17.6	18.7	1.96	1.43
1-1230	1.2	12.7	14.7	226.	0.20	4.5	3.5	18.0	18.7	1.41	1.40
1-1330	1.6	12.7	14.4	221.	0.20	2.5	3.5	18.4	18.4	1.57	1.70
1-1430	1.4	12.7	14.6	283.	0.20	2.1	3.7	18.4	18.4	1.57	1.48
1-1530	1.4	12.7	14.6	283.	0.30	2.9	3.3	18.5	18.5	1.40	1.42
1-1630	1.2	12.7	14.7	192.	0.30	4.2	2.7	18.7	18.7	1.41	1.48
1-1730	1.2	12.7	14.7	185.	0.30	4.4	2.7	18.7	18.7	1.40	1.40
1-1830	1.5	12.7	14.5	189.	0.30	4.7	2.2	18.0	18.0	1.33	1.43
1-1930	1.3	12.7	14.6	179.	0.30	5.2	5.4	19.0	19.0	1.08	1.16
1-2030	1.5	13.0	14.5	182.	0.50	6.4	4.0	19.3	19.3	1.08	1.13
1-2130	1.5	12.7	14.5	182.	0.40	6.5	6.2	19.2	19.2	1.08	1.17
1-2230	1.5	12.7	14.5	182.	0.30	6.4	7.4	19.2	19.2	1.28	1.17
1-2330	1.6	12.2	14.5	182.	0.30	4.6	8.0	19.1	19.1	1.08	1.19
2-0030	1.7	14.0	14.4	174.	0.30	4.7	8.9	19.4	19.4	1.08	1.16
2-0130	2.0	12.2	14.0	172.	0.40	4.0	9.0	19.1	19.1	1.08	1.25
2-0230	3.2	14.0	13.2	170.	0.40	4.5	9.4	19.3	19.3	1.16	1.34
2-0330	2.6	14.0	13.7	154.	0.30	5.0	8.2	19.0	19.0	1.33	1.52
2-0430	2.6	14.0	13.5	157.	0.30	6.0	8.5	19.0	19.0	1.33	1.52
2-0530	3.0	14.0	13.4	159.	0.35	6.0	8.4	19.4	19.4	1.08	1.24
2-0630	2.0	14.0	14.2	159.	0.30	1.6	7.0	19.4	19.4	1.08	1.18

2.0730	1.6	14.0	14.5	159.	0.40	5.9	7.0	19.4	19.4	1.00	1.15
2.0830	2.2	12.2	14.0	156.	0.40	4.4	8.6	19.3	19.3	4.99	1.10
2.0930	2.4	12.2	13.8	157.	0.50	4.6	8.8	19.3	19.3	[illegible]	1.11
2.1030	1.7	14.0	14.4	158.	0.30	6.3	6.6	19.5	19.5	0.99	1.09
2.1130	2.2	14.0	14.0	159.	0.30	5.4	5.8	19.0	19.0	1.33	1.40
2.1230	1.8	12.2	14.3	158.	0.30	5.0	5.6	18.9	19.0	1.24	1.23
2.1330	1.7	12.2	14.4	156.	0.30	2.4	6.8	19.0	19.0	1.26	1.26
2.1430	1.7	12.4	14.4	174.	0.30	1.9	7.0	19.3	19.3	0.99	1.10
2.1530	1.2	12.2	14.3	172.	0.40	2.3	5.6	17.1	19.1	2.09	1.38
2.1630	1.9	12.2	14.2	211.	0.40	1.9	5.8	17.5	18.7	2.04	1.40
2.1730	1.4	12.2	14.5	253.	0.50	1.4	4.8	16.5	18.0	2.50	1.39
2.1830	1.8	14.0	14.2	258.	0.50	1.7	5.4	17.1	18.8	2.60	1.63
2.1930	2.4	14.0	13.8	257.	0.56	1.6	6.0	17.3	18.8	2.44	1.63
2.2030	2.3	14.0	13.9	259.	0.20	1.7	6.6	15.3	16.7	3.02	3.19
2.2130	2.4	12.7	13.8	215.	0.40	4.3	5.4	16.2	17.4	2.93	2.44
2.2230	2.5	12.4	13.7	233.	0.40	1.3	5.0	16.5	18.1	2.02	1.93
2.2330	2.7	13.0	13.5	[illegible]	0.40	1.2	4.6	16.7	18.0	2.08	2.10
3.0030	1.5	12.7	14.5	[illegible]	0.50	1.1	5.2	16.6	18.0	2.08	1.97
3.0130	1.4	13.5	14.6	257.	0.40	1.4	4.4	17.3	18.0	2.36	2.10
3.0230	3.2	12.2	13.3	255.	0.40	1.2	4.0	17.3	18.3	2.12	1.93
3.0330	2.2	12.2	14.0	253.	0.40	1.6	6.4	14.4	16.6	3.02	2.85
3.0430	2.3	12.4	13.9	311.	0.40	1.5	5.6	14.7	16.2	3.73	3.17
3.0530	2.4	12.4	13.8	366.	0.30	1.4	5.6	14.9	16.3	3.63	3.14
3.0630	2.2	12.4	14.0	405.	0.20	1.2	7.0	14.5	15.9	3.92	3.35
3.0730	2.2	12.2	14.0	455.	0.40	1.4	5.8	14.1	15.6	4.02	3.50
3.0830	2.2	12.2	14.0	516.	0.30	1.0	8.2	13.9	15.6	4.11	3.52
3.0930	2.8	12.2	13.5	639.	0.70	0.6	7.0	13.9	15.0	4.11	3.51
3.1030	3.5	14.0	12.7	553.	0.70	1.4	6.6	15.0	16.2	4.02	3.95
3.1130	3.5	14.0	12.7	431.	0.70	1.4	6.6	15.0	16.0	4.02	4.10
3.1230	3.8	14.0	12.8	431.	0.60	1.7	6.2	15.0	16.5	3.63	3.45
3.1330	3.9	14.0	12.7	384.	0.60	1.4	6.2	15.0	17.2	3.10	3.14
3.1430	4.0	14.0	12.6	323.	0.50	2.2	6.4	15.0	17.6	2.76	2.87
3.1530	4.0	14.0	12.6	291.	0.50	2.5	6.4	15.0	17.6	2.66	2.92
3.1630	4.0	14.0	12.6	291.	0.30	2.2	5.8	15.0	17.6	2.44	2.70
3.1730	4.3	14.0	12.4	259.	0.30	1.5	6.2	15.0	18.0	2.36	2.52
3.1830	4.5	14.0	12.3	295.	0.30	1.4	6.8	15.0	18.0	2.30	2.52

APPENDIX F: TABLE V- PAGE 2 OF 4

RUN 8: GAS COMPOSITIONS

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
3-1930	4.4	14.0	12.3	298.	0.30	2.3	6.2	15.0	18.1	2.20	2.40
3-2030	3.3	12.2	13.1	303.	0.30	2.5	6.4	15.0	18.1	2.20	1.98
3-2130	2.9	12.2	13.5	293.	0.40	2.5	6.2	15.0	18.0	2.12	1.98
3-2230	3.0	14.0	13.4	311.	0.40	2.0	7.0	15.0	18.1	2.32	2.27
3-2330	3.2	14.0	13.2	278.	0.40	2.0	6.6	15.0	18.0	1.96	2.38
4-0030	3.3	14.0	13.2	229.	0.40	2.4	7.2	17.0	18.5	1.96	1.99
4-0130	3.2	14.0	13.2	282.	0.40	2.0	7.4	17.0	18.5	1.96	1.97
4-0230	2.2	12.2	14.0	280.	0.40	3.0	6.2	17.3	18.5	2.20	1.65
4-0330	2.2	12.4	14.0	239.	0.40	2.5	6.2	17.0	18.5	2.20	1.68
4-0430	2.8	14.0	13.5	212.	0.40	3.0	6.6	18.0	18.5	1.96	1.97
4-0530	2.6	12.2	13.7	192.	0.40	1.9	5.4	18.0	18.5	1.96	1.62
4-0630	3.0	14.0	13.4	184.	0.40	2.2	5.2	18.0	18.6	1.96	1.88
4-0730	2.4	14.0	13.9	213.	0.40	3.1	6.6	18.0	18.6	2.76	1.81
4-0830	2.2	12.2	14.0	245.	0.40	3.0	6.8	17.3	18.5	2.68	1.69
4-0930	2.2	14.0	14.1	239.	0.40	2.8	7.0	17.3	18.9	2.20	1.60
4-1030	2.2	12.2	14.0	237.	0.40	2.9	6.8	16.6	18.9	2.40	1.39
4-1130	2.2	12.2	14.0	258.	0.40	2.9	6.9	16.6	18.9	2.60	1.35
4-1230	2.2	12.2	14.0	291.	0.40	2.8	6.6	16.6	18.9	2.76	1.36
4-1330	2.3	12.2	13.9	297.	0.40	3.0	7.0	16.6	18.9	2.60	1.36
4-1430	2.3	12.2	13.9	303.	0.60	2.9	6.8	16.6	18.9	2.40	1.36
4-1530	2.4	12.7	13.9	301.	0.50	3.0	6.0	16.6	18.9	2.52	1.42
4-1630	2.0	12.4	14.2	303.	0.50	3.1	4.4	16.6	18.8	2.44	1.42
4-1730	2.1	12.4	14.1	313.	0.50	3.8	6.4	16.6	18.8	2.52	1.42
4-1830	2.1	12.4	14.1	303.	0.50	3.9	7.0	16.6	18.8	2.40	1.42
4-1930	2.1	12.7	14.1	293.	0.50	4.2	7.4	16.6	18.8	2.17	1.45
4-2030	2.1	12.7	14.1	290.	0.40	5.3	7.4	17.0	18.8	2.04	1.45
4-2130	2.2	12.2	14.0	273.	0.30	3.9	7.0	18.1	18.1	1.81	1.48
4-2230	2.8	12.2	13.6	270.	1.00	4.3	6.6	18.0	18.8	1.73	1.47

4-2330	2.2	12.4	14.0	263.	0.40	4.5	5.8	18.2	18.2	1.81	1.85
5-0030	2.0	12.4	14.0	259.	0.50	4.7	6.4	18.2	18.2	1.81	1.85
5-0130	2.3	14.0	13.9	249.	0.50	4.7	6.4	18.1	18.1	1.73	2.17
5-0230	2.3	14.0	13.9	247.	1.00	4.1	6.6	18.1	18.1	1.81	2.17
5-0330	2.7	14.0	13.6	251.	0.30	4.5	7.0	18.1	18.1	1.81	2.22
5-0430	2.2	14.0	14.0	249.	0.30	4.3	7.0	18.0	18.6	1.65	1.75
5-0530	2.6	14.0	13.7	243.	0.00	4.3	6.8	18.0	18.7	1.73	1.74
5-0630	2.2	14.0	14.0	243.	0.50	3.5	6.2	18.4	18.4	1.65	1.94
5-0730	2.2	14.0	14.0	248.	0.00	4.1	7.6	18.6	18.6	1.57	1.70
5-0830	1.8	12.2	14.4	258.	0.40	4.2	7.4	18.9	18.9	1.57	1.33

SHUT DOWN AT 5-0830 FOR 3 HOURS

5-1130	2.6	14.0	13.8	371.	0.40	3.9	7.0	17.4	18.9	2.36	1.68
5-1230	1.5	14.0	14.6	329.	0.40	3.0	6.6	17.4	18.1	3.01	2.06
5-1330	2.0	14.0	14.2	344.	0.50	3.0	6.2	17.2	18.2	2.69	2.06
5-1430	2.1	14.0	14.1	339.	0.50	3.0	6.8	19.5	19.5	2.28	1.11
5-1530	1.9	12.2	14.3	329.	0.30	3.9	6.4	19.8	19.8	1.96	0.77
5-1630	1.9	12.2	14.3	327.	0.30	4.5	6.8	19.2	19.2	1.73	1.15
5-1730	1.8	12.2	14.3	324.	0.30	5.3	6.0	19.4	19.4	1.57	1.02
5-1830	2.6	14.0	13.7	305.	0.70	4.4	5.8	19.2	19.2	1.41	1.37
5-1930	1.6	12.2	14.5	296.	0.50	3.3	5.6	19.2	19.2	1.41	1.13
5-2030	2.3	14.0	14.0	338.	0.50	2.6	5.6	19.2	19.2	1.16	1.35
5-2130	2.2	14.0	14.0	348.	0.50	2.0	5.6	18.0	18.6	2.20	1.02
5-2230	2.2	14.0	14.0	349.	0.50	2.0	5.8	18.0	18.4	2.20	1.94
5-2330	2.1	14.0	14.1	314.	0.40	2.4	5.4	18.0	18.7	2.04	1.67
6-0030	2.2	14.0	14.0	313.	0.40	2.4	5.4	18.0	18.8	2.12	1.67
6-0130	2.2	14.0	14.0	295.	0.50	2.8	5.4	18.0	18.8	1.96	1.67
6-0230	2.2	14.0	14.0	303.	0.40	2.8	5.4	18.0	18.4	1.96	1.94
6-0330	2.0	14.0	14.1	334.	0.30	2.5	5.0	17.0	17.7	2.76	2.44
6-0430	2.2	14.0	13.9	343.	0.30	2.3	5.2	17.2	17.7	2.59	2.44
6-0530	2.0	12.2	14.1	301.	0.30	2.4	5.0	17.2	17.7	2.60	2.14
6-0630	2.2	14.0	14.0	309.	0.40	2.8	5.0	17.2	17.8	2.68	2.38
6-0730	2.1	14.0	14.0	318.	0.40	3.1	5.4	17.3	17.7	2.59	2.44
6-0830	2.0	14.0	13.9	316.	0.50	3.5	5.8	17.3	17.7	2.44	2.40

APPENDIX F: TABLE 6.

RUN 6: GAS COMPOSITIONS PAGE 3 OF 4

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
6-0930	2.5	14.2	13.7	312.	0.20	4.2	6.6	17.6	17.8	2.28	2.46
6-1030	2.3	14.0	13.5	312.	0.10	3.6	7.0	17.6	18.4	2.20	1.97
6-1130	2.5	14.0	13.8	313.	0.10	5.1	7.2	18.0	18.4	2.04	1.97
6-1230	1.5	14.0	14.5	308.	0.10	[illegible]	7.0	17.5	18.3	2.20	1.97
6-1330	2.0	14.0	14.2	300.	0.10	5.0	6.4	17.4	18.2	2.36	2.05
6-1430	2.5	14.0	13.8	298.	0.20	6.7	6.8	17.5	18.2	2.28	2.01
6-1530	2.1	14.0	14.1	291.	0.10	5.8	6.6	17.9	18.3	2.12	1.97
6-1630	1.9	14.0	14.2	296.	0.10	4.9	6.8	17.8	18.3	2.12	1.97
6-1730	2.2	14.0	14.0	310.	0.20	3.8	6.4	18.1	18.1	2.04	2.16
6-1830	2.2	14.0	14.0	307.	0.20	4.0	6.6	16.8	18.4	2.08	1.97
6-1930	2.2	14.0	14.6	308.	0.20	3.8	6.6	16.8	18.4	2.08	1.97
6-2030	2.2	14.2	14.0	322.	0.20	4.2	7.4	16.9	18.4	2.08	1.97
6-2130	2.2	14.0	14.0	313.	0.20	2.5	4.6	17.0	18.4	2.08	1.97
6-2230	2.1	14.0	14.1	303.	0.20	4.5	7.4	16.8	18.3	2.62	1.99
6-2330	2.2	14.0	14.0	296.	0.30	5.4	7.0	16.9	18.3	2.08	2.02
7-0030	2.6	14.0	13.7	287.	0.20	4.3	7.0	16.8	18.3	2.76	2.07
7-0130	2.9	14.0	13.5	272.	0.20	3.7	7.0	17.3	18.4	2.44	2.02
7-0230	2.7	14.0	13.6	263.	0.20	3.7	6.6	17.3	18.4	2.44	2.02
7-0330	2.4	14.0	13.8	273.	0.20	3.7	6.6	17.2	18.2	2.52	2.08
7-0430	2.6	14.0	13.7	255.	0.20	4.7	6.6	16.9	18.2	2.60	2.10
7-0530	2.6	14.0	13.7	243.	0.30	3.5	5.8	16.9	18.2	2.60	2.10
7-0630	2.9	14.3	13.5	237.	0.20	4.7	7.0	16.9	18.3	2.60	2.10
7-0730	1.5	14.0	14.5	266.	0.10	3.9	6.2	17.0	18.1	2.52	2.12
7-0830	1.2	13.8	14.7	275.	0.20	3.5	7.4	17.1	18.0	2.44	2.07
7-0930	1.6	13.8	14.4	297.	0.20	[illegible]	7.0	17.2	18.2	2.20	2.02
7-1030	2.2	13.5	14.0	324.	0.20	3.0	6.2	17.2	17.9	3.54	2.03
7-1130	1.5	14.1	14.5	323.	0.30	3.0	5.8	15.9	17.4	3.45	2.57
7-1230	1.6	13.8	14.4	314.	0.30	3.0	5.8	16.2	17.5	3.10	2.51

7.1330	2.2	13.5	14.1	299.	0.30	3.7	6.6	14.2	20.1	3.10	2.20
7.1430	2.1	13.5	14.0	295.	0.40	2.8	5.4	16.1	17.4	3.02	2.57
7.1530	1.0	14.1	14.8	303.	0.40	3.8	5.6	16.4	17.2	3.02	2.44
7.1630	0.2	14.4	15.0	354.	0.40	3.1	6.2	16.2	16.6	3.02	3.10
7.1730	1.2	14.4	14.7	431.	0.40	2.8	5.4	18.2	20.8	0.99	1.40
7.1830	1.6	13.8	14.5	463.	0.40	1.6	5.0	20.2	20.2	0.	0.57
7.1930	1.0	14.1	14.9	547.	0.40	1.4	5.4	22.2	22.2	0.	0.56
7.2030	2.2	13.5	14.0	362.	0.40	1.6	5.4	20.4	20.4	0.	0.42
7.2130	2.2	13.5	14.2	370.	0.40	1.7	5.4	21.0	21.0	0.	0.
7.2230	2.2	13.8	14.0	374.	0.50	2.0	5.4	21.0	21.0	0.	0.
7.2330	2.2	13.9	14.0	389.	0.50	1.7	5.4	20.6	20.6	0.	0.90
8.0030	2.9	13.5	13.4	406.	0.80	1.5	4.8	17.2	17.7	2.84	2.43
8.0130	2.8	13.5	13.5	391.	0.80	2.3	5.0	16.2	17.4	3.27	2.65
8.0230	2.5	13.8	13.7	324.	0.80	2.8	4.8	16.6	17.4	3.18	2.70
8.0330	2.9	13.5	13.5	330.	0.80	3.1	5.8	16.6	17.4	3.10	2.65
8.0430	2.9	13.2	13.4	319.	0.80	3.5	5.0	16.6	17.4	3.10	2.60
8.0530	3.0	13.5	13.4	326.	0.80	3.0	5.6	16.7	17.5	2.93	2.65
8.0630	2.7	13.5	13.6	329.	0.90	3.1	4.8	16.1	17.0	3.45	2.93
8.0730	2.6	13.2	13.6	334.	0.80	3.0	5.4	16.1	16.9	3.45	2.84
8.0830	2.5	13.5	13.7	399.	1.00	3.1	5.0	16.1	17.0	3.36	2.91
8.0930	2.4	12.7	13.8	410.	1.00	3.2	5.0	16.1	17.0	3.02	2.70
8.1030	2.4	13.2	13.8	415.	0.40	4.3	5.0	16.1	17.2	3.02	2.60
8.1130	2.4	13.2	13.8	420.	0.40	3.7	5.2	16.2	17.2	3.45	2.60
8.1230	2.2	13.5	14.0	425.	0.40	3.2	5.4	16.2	17.5	3.27	2.54
8.1330	2.1	13.5	14.0	430.	0.40	3.0	5.4	16.2	17.4	3.10	2.54
8.1430	2.2	13.5	14.0	445.	0.40	3.1	5.4	16.2	12.6	3.10	6.84
8.1530	2.2	13.5	14.0	465.	0.40	3.1	5.4	16.2	12.6	3.10	6.84
8.1630	2.2	13.5	14.0	480.	0.50	3.1	5.0	16.2	17.5	3.10	2.55
8.1730	2.2	13.5	13.9	430.	0.60	3.1	4.6	16.2	17.2	3.10	2.76
8.1830	2.5	13.5	13.7	399.	0.50	3.6	5.4	16.2	17.5	3.10	2.55
8.1930	2.4	13.5	13.8	402.	0.52	2.5	4.6	15.6	16.5	3.02	3.25
8.2030	2.4	13.5	13.4	495.	1.02	1.9	4.6	15.6	16.4	4.21	3.32
8.2130	2.4	13.2	13.8	534.	1.20	1.6	4.2	15.5	16.4	4.21	3.00
8.2230	2.4	13.2	13.8	513.	1.10	1.4	4.4	15.0	16.6	4.21	3.14
8.2330	2.6	13.2	13.6	524.	1.00	1.7	4.8	15.0	16.7	4.21	3.10
9.0030	2.7	13.2	13.6	597.	1.00	1.9	5.0	15.0	16.7	4.21	3.10

APPENDIX D: TABLE 6.

RUN 4: GAS COMPOSITIONS PAGE 4 OF 8

DAY-HOUR	F L U E	G A S			REGENERATOR GAS			GASIFIER INLET GAS			
	O2	CO2 VOL %		SO2	O2	CO2	SO2	O2 VOL %		CO2 VOL %	
	%	ANAL	CALC	PPM	%	%	%	ANAL	CALC	ANAL	CALC
9-0130	2.7	13.7	13.6	523.	1.00	1.7	4.6	15.0	16.8	4.21	3.00
9-0230	2.7	13.2	13.6	523.	1.00	1.7	4.6	15.0	16.9	4.21	2.95
9-0330	2.7	13.2	13.6	534.	1.00	1.9	4.6	14.7	16.6	4.42	3.17
9-0430	2.2	13.2	13.9	514.	1.00	2.3	5.2	14.7	16.6	4.32	3.13
9-0530	2.0	13.5	14.1	496.	1.00	1.9	5.0	14.6	16.7	4.21	3.07
9-0630	2.0	13.5	14.1	479.	1.06	2.3	4.6	14.6	16.7	4.52	3.07
9-0730	1.8	13.8	14.2	461.	1.00	3.0	5.0	15.0	17.1	4.02	2.78
9-0830	1.7	13.8	14.3	445.	0.70	2.5	4.8	15.1	17.0	3.92	2.87
9-0930	1.5	13.8	14.4	465.	0.70	2.6	5.2	15.2	17.1	3.92	2.80
9-1030	1.8	13.2	14.3	465.	0.70	2.7	5.6	15.2	17.1	3.82	2.69
9-1130	1.8	13.2	14.3	511.	0.70	3.1	5.4	15.2	17.0	3.82	2.75
9-1230	1.6	13.5	14.4	576.	1.20	2.6	4.6	15.3	16.9	4.02	2.87
9-1330	1.7	13.5	14.3	569.	1.00	1.7	4.6	15.2	16.9	4.02	2.87
9-1430	1.7	13.5	14.3	566.	1.00	2.3	4.6	15.2	16.9	4.02	2.87
9-1530	1.7	13.5	14.3	578.	1.20	2.2	4.2	15.2	16.8	4.02	2.94
9-1630	1.8	13.5	14.2	584.	0.80	1.9	4.6	15.2	16.9	4.02	2.87
9-1730	1.6	13.5	14.4	589.	0.80	2.3	5.0	15.0	16.9	4.02	2.87
9-1830	2.0	13.2	14.1	627.	0.80	2.2	4.4	15.1	16.8	3.92	2.95
9-1930	1.3	13.2	14.2	540.	0.80	3.1	5.0	15.1	16.9	3.92	2.80
9-2030	2.0	13.2	14.1	530.	1.00	2.4	4.6	15.1	17.1	3.82	2.73
9-2130	2.0	13.2	14.1	546.	1.00	2.6	4.4	15.1	16.9	3.92	2.87
9-2230	2.0	13.2	14.1	595.	1.00	3.7	4.2	15.1	16.9	4.11	2.84
SHUT DOWN AT 9-2230 FOR 23 HOURS											
10-2230	4.3	14.0	12.4	-	0.50	0.9	0.3	16.1	17.1	3.54	3.30
10-2330	3.2	12.4	13.3	339.	0.50	1.0	3.7	16.6	17.5	3.10	2.47
11-0030	2.7	13.0	13.7	374.	0.20	1.6	5.0	16.7	13.9	3.01	2.10
11-0130	2.8	13.0	13.C	372.	0.20	1.9	5.0	17.5	17.9	2.44	2.10
11-0230	2.5	13.0	13.4	331.	0.20	2.6	5.0	17.7	17.9	2.36	2.10

11-0330	2.5	13.0	13.8	313.	0.10	4.4	5.2	17.7	18.6	2.20	1.60
11-0430	2.7	13.0	13.7	334.	0.20	4.2	6.6	18.0	18.6	2.12	1.60
11-0530	2.4	13.0	13.9	346.	0.30	4.5	6.2	17.1	17.4	2.03	2.40
11-0630	2.4	13.0	13.9	368.	0.30	4.4	6.0	16.8	17.0	2.03	2.10
11-0730	2.4	13.0	13.9	401.	0.30	4.4	4.4	16.8	17.0	2.03	2.17

SHUT DOWN AT 11-0730 FOR 19 HOURS

12-0330	5.5	14.0	11.6	-	0.	0.1	0.	20.0	20.0	0.00	0.00
12-0430	5.9	14.0	11.2	-	1.20	0.4	0.	19.5	19.5	2.10	2.30
12-0530	5.4	14.0	11.6	-	2.50	0.4	0.	19.3	19.3	2.36	2.42
12-0630	4.9	14.0	12.1	-	2.60	0.5	0.	19.4	19.4	1.40	2.25
12-0730	4.4	14.0	12.4	-	0.10	0.3	2.2	20.0	20.0	0.53	0.84
12-0830	4.5	14.0	12.3	1071.	1.00	0.2	0.7	19.5	19.5	0.40	1.27
12-0930	4.7	14.0	12.2	1055.	1.20	0.3	1.2	19.6	19.6	0.63	1.08
12-1030	4.2	14.0	12.5	977.	4.00	0.2	0.	19.7	19.7	0.23	1.08
12-1130	3.5	13.7	13.0	958.	4.00	0.4	0.	19.9	19.9	0.44	0.00
12-1230	3.0	13.0	13.4	936.	1.00	0.4	1.5	19.9	19.9	0.44	3.70
12-1330	3.0	13.0	13.4	812.	1.00	0.3	1.5	19.9	19.9	0.40	0.70
12-1430	3.0	13.0	13.4	812.	5.00	0.6	0.	19.8	19.8	1.33	1.44
12-1530	3.0	13.2	13.4	1077.	1.50	0.4	0.	19.8	19.8	1.33	1.47
12-1630	2.9	13.2	13.5	961.	1.00	0.4	2.7	19.6	19.6	1.16	1.08
12-1730	5.3	14.0	11.5	821.	1.98	0.4	3.5	19.9	19.9	0.99	0.97
12-1830	3.0	13.0	13.5	573.	0.	0.4	1.2	20.4	20.0	0.44	0.72
12-1930	2.9	13.2	13.5	383.	0.40	2.6	5.0	19.4	19.4	0.90	1.17
12-2030	2.5	13.2	13.8	330.	0.20	2.9	5.4	19.5	19.5	0.90	1.07
12-2130	2.7	13.2	13.6	305.	0.20	4.0	5.6	19.5	19.5	0.90	1.08
12-2230	2.8	13.2	13.6	291.	0.10	4.7	6.0	19.6	19.6	0.42	1.02
12-2330	2.5	13.2	13.8	281.	3.40	4.1	5.4	19.4	19.4	0.91	1.00
13-0030	2.5	13.2	13.8	270.	0.20	7.5	5.4	19.8	19.6	0.72	0.83
13-0130	2.8	13.2	13.6	255.	0.50	4.5	5.4	19.8	19.8	0.72	0.87
13-0230	2.8	13.2	13.6	258.	0.20	4.5	5.0	19.1	19.1	1.57	1.30

APPENDIX [illegible] TABLE [illegible]

RUN [illegible] GAS COMPOSITIONS PAGE 5 OF [illegible]

DAY-HOUR	FLUE GAS O2 %	CO2 VOL % ANAL.	 CALC	 SO2 PPM	REGENERATOR GAS O2 %	 CO2 %	 SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	 CALC	 CO2 VOL % ANAL	 CALC
13-0330	3.0	13.2	13.[illegible]	317.	0.20	2.0	4.6	20.3	20.3	0.63	0.58
13-0430	2.8	13.2	13.6	474.	0.20	1.1	5.2	20.0	20.0	0.63	0.73
13-0530	2.8	13.2	13.6	518.	0.20	0.8	5.6	20.2	20.2	0.63	0.57
13-0630	2.9	13.2	13.5	531.	0.20	0.6	5.2	20.0	20.0	0.63	0.73
13-0730	3.0	13.2	13.5	538.	0.50	0.5	6.6	20.0	20.0	0.63	0.74
13-0830	2.8	13.2	13.6	560.	0.20	0.5	6.2	20.0	20.0	0.53	0.73
13-0930	2.8	13.2	13.6	583.	0.20	0.4	5.8	20.0	20.0	0.53	0.73
13-1030	3.0	13.2	13.5	582.	0.20	0.4	4.8	20.0	20.0	0.44	0.74
13-1130	3.0	13.0	13.5	544.	0.30	0.4	5.6	20.2	20.2	0.44	0.58
13-1230	2.9	13.2	13.5	567.	0.50	0.2	5.0	20.2	20.2	0.34	0.58
13-1330	3.0	13.2	13.5	567.	0.90	0.3	3.5	20.2	20.2	0.34	0.59
13-1430	2.8	13.2	13.6	541.	0.40	0.3	4.4	20.3	20.3	0.34	0.58
13-1530	2.9	13.2	13.5	555.	0.70	0.3	4.8	20.3	20.3	0.23	0.58
13-1630	2.6	13.2	13.8	549.	0.70	0.3	4.6	20.4	20.4	0.23	0.40
13-1730	2.4	13.2	13.9	527.	0.70	0.3	4.2	20.4	20.4	0.23	0.40
13-1830	2.5	13.2	13.8	509.	0.40	0.3	5.0	20.4	20.4	0.13	0.40
13-1930	2.3	13.2	14.0	504.	0.46	0.4	5.2	20.6	20.6	0.13	0.30
13-2030	2.3	13.2	14.0	495.	0.30	0.4	5.0	20.6	20.6	0.	0.29
13-2130	2.3	13.5	14.0	495.	0.40	0.4	5.4	20.6	20.6	0.	0.29
13-2230	2.4	13.5	13.9	474.	0.40	0.4	5.0	20.8	20.8	0.	0.15
13-2330	2.4	13.5	13.9	464.	0.40	0.3	5.0	20.6	20.6	0.	0.29
14-0030	2.5	13.5	13.9	420.	3.00	1.1	5.4	20.6	20.6	0.	0.29
14-0130	2.8	13.2	13.6	335.	0.30	3.0	5.8	20.6	20.6	0.	0.29
14-0230	2.9	13.2	13.5	308.	0.30	3.1	5.8	20.8	20.8	0.	0.15
14-0330	2.4	13.5	13.9	294.	0.30	3.6	5.8	20.8	20.8	0.	0.15
14-0430	2.4	13.5	13.9	288.	0.20	3.8	5.8	20.8	20.8	0.	0.15
14-0530	2.4	13.5	13.9	275.	0.20	4.0	6.2	20.8	20.8	0.	0.15
14-0630	2.4	13.5	13.9	279.	0.20	3.9	6.2	20.8	20.8	0.	0.15

14-0730	2.7	13.5	14.1	299.	0.30	4.0	4.2	29.8	29.8	0.	0.14
14-0830	2.2	13.5	14.1	295.	0.25	4.3	6.2	29.8	29.8	0.	0.14
14-0930	2.0	13.5	14.2	294.	0.30	4.9	6.4	29.8	29.8	0.	0.14
14-1030	2.0	13.4	14.2	302.	0.20	5.2	6.4	29.9	29.9	0.	0.07
14-1130	2.2	13.5	14.1	298.	0.10	5.0	6.4	29.9	29.9	0.	0.07
14-1230	2.3	13.5	14.0	302.	0.10	4.4	6.6	29.9	29.9	0.	0.07
14-1330	2.5	13.5	13.8	305.	0.10	4.5	6.6	29.9	29.9	0.	0.07
14-1430	2.3	13.5	14.0	304.	0.10	4.7	6.8	29.9	29.9	0.	0.07
14-1530	2.2	13.5	14.1	298.	0.10	4.3	6.6	29.9	29.9	0.	0.07
14-1630	2.6	13.2	13.8	314.	0.10	4.5	6.4	29.9	29.9	0.	0.07
14-1730	2.3	13.5	14.0	320.	1.50	3.8	6.6	29.9	29.9	0.	0.07
14-1830	2.2	13.5	14.1	307.	0.16	3.4	6.4	29.6	29.8	0.	0.14
14-1930	2.5	13.2	13.6	298.	0.20	3.1	7.0	29.8	29.8	0.	0.14
14-2030	2.8	13.2	13.6	304.	0.10	2.3	7.4	29.8	29.8	0.	0.15
14-2130	2.8	13.2	13.6	318.	0.20	2.8	6.8	29.8	29.8	0.	0.15
14-2230	2.5	13.2	13.8	304.	0.20	3.8	6.6	29.8	29.8	0.	0.14
14-2330	2.6	13.2	13.8	310.	0.20	3.8	6.6	29.8	29.8	0.	0.14
15-0030	2.6	13.2	12.8	300.	0.20	3.7	6.2	29.6	29.8	0.	0.14
15-0130	2.3	13.2	13.6	287.	0.20	3.6	6.2	29.8	29.8	0.	0.15
15-0230	2.8	13.2	13.6	275.	0.40	3.3	6.0	29.8	29.8	0.	0.15
15-0330	2.9	13.2	13.5	258.	0.40	3.2	5.6	29.8	29.8	0.	0.15
15-0430	2.9	13.2	13.5	253.	0.40	3.1	5.4	29.8	29.8	0.	0.15
15-0530	2.7	13.2	13.7	258.	0.50	2.4	5.6	29.8	29.8	0.	0.24
15-0630	2.4	13.2	13.9	257.	0.80	3.1	5.6	29.8	29.8	0.	0.14
15-0730	2.4	13.2	13.9	257.	0.80	3.0	5.4	29.8	29.8	0.	0.14
15-0830	2.2	13.5	14.1	290.	0.60	3.1	4.6	29.6	29.6	0.	0.29
15-0930	2.1	13.5	14.2	324.	0.60	3.7	5.4	29.6	29.6	0.	0.29
15-1030	2.0	13.5	14.2	339.	0.60	3.9	5.4	29.6	29.6	0.	0.28
15-1130	1.9	13.5	14.3	364.	0.60	4.6	5.2	29.6	29.6	0.	0.28
15-1230	1.9	13.8	14.3	359.	0.40	4.3	5.6	29.6	29.6	0.	0.29
15-1330	1.9	13.8	14.3	349.	0.60	3.8	5.2	29.6	29.6	0.	0.29
15-1430	2.3	13.2	14.0	343.	0.50	4.2	5.4	29.6	29.6	0.	0.28
15-1530	2.2	13.2	14.1	329.	0.70	4.4	5.4	29.6	29.6	0.	0.28
15-1630	2.4	13.2	13.9	308.	0.70	4.2	5.2	29.6	29.6	0.	0.28
15-1730	2.8	13.2	13.6	287.	0.70	5.0	5.8	29.6	29.6	0.	0.29
15-1830	2.9	13.2	13.5	269.	0.70	4.8	5.8	29.6	29.6	0.	0.22

APPENDIX B - TABLE 1-

RUN 4: GAS COMPOSITIONS PAGE 4 OF 8

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
15-1930	2.9	13.0	13.5	257.	0.60	3.9	5.8	20.7	20.7	0.	0.21
15-2030	3.1	13.0	13.4	244.	0.60	3.1	6.0	20.7	20.7	0.	0.20
15-2130	3.1	13.0	13.4	238.	0.60	2.8	6.6	20.7	20.7	0.	0.22
15-2230	2.4	13.5	13.9	260.	0.60	2.5	5.8	20.7	20.7	0.	0.22
15-2330	2.4	13.5	13.9	275.	0.60	2.3	6.2	20.7	20.7	0.	0.22
16-0030	2.6	13.5	13.8	274.	0.60	2.5	6.2	20.7	20.7	0.	0.22
16-0130	2.1	13.6	14.1	288.	0.50	2.5	6.2	20.7	20.7	0.	0.22
16-0230	2.4	13.8	13.9	238.	0.60	3.2	5.8	20.6	20.6	0.	0.30
16-0330	2.5	13.2	13.8	287.	0.60	3.3	6.6	20.6	20.6	0.	0.29
16-0430	2.6	13.2	13.8	279.	0.60	4.0	6.0	20.6	20.6	0.	0.29
16-0530	1.6	13.2	14.5	313.	0.60	8.1	6.6	20.6	20.6	0.	0.27
16-0630	2.2	13.0	14.1	408.	0.60	16.0	0.	20.6	20.6	0.	0.28
16-0730	2.2	12.7	14.1	386.	0.60	18.0	0.	20.6	20.6	0.	0.27
16-0830	4.0	12.2	12.7	348.	1.20	18.0	0.	20.6	20.6	0.	0.29
16-0930	4.0	14.0	12.7	257.	0.10	18.0	3.5	20.5	20.5	0.	0.46
16-1030	3.2	12.7	13.3	255.	0.30	5.8	7.8	17.9	18.4	2.90	1.85
16-1130	3.0	12.7	13.4	304.	0.30	3.3	7.8	17.7	18.2	2.44	1.97
16-1230	3.0	12.7	13.4	311.	0.30	2.7	7.4	18.2	18.2	1.80	1.90
16-1330	2.9	13.0	13.5	283.	0.30	4.3	6.6	19.0	19.0	1.40	1.43
16-1430	3.2	12.7	13.3	273.	0.10	18.0	5.0	20.2	20.2	0.23	0.57
16-1530	2.9	13.0	13.5	236.	0.30	6.0	7.2	20.4	20.4	0.25	0.43
16-1630	1.9	13.5	14.2	194.	0.20	3.8	7.8	20.4	20.4	0.13	0.40
16-1730	1.5	13.5	14.6	229.	0.25	5.4	6.6	20.4	20.4	0.07	0.40
16-1830	1.6	13.8	14.5	250.	0.30	3.9	6.8	20.4	20.4	0.	0.43
16-1930	1.9	13.5	14.3	240.	0.30	4.4	6.9	20.4	20.4	0.	0.40
16-2030	1.5	13.5	14.6	273.	0.10	5.4	6.0	20.6	20.6	0.	0.30
16-2130	1.9	13.5	14.3	287.	0.30	5.8	6.6	20.5	20.5	0.	0.14
16-2230	2.2	13.0	14.0	281.	0.30	10.0	4.8	20.5	20.5	0.	0.34

16-2330	2.6	13.0	13.9	373.	0.	7.5	0.7	29.6	29.6	0.	0.39
17-0030	2.8	12.7	13.6	311.	0.	10.0	0.	29.6	29.6	0.	0.39
17-0130	2.6	12.7	13.8	295.	0.	9.8	0.	29.6	29.6	0.	0.39
17-0230	2.5	13.0	13.9	289.	0.	10.0	2.	29.4	29.4	0.	0.42
17-0330	2.5	12.7	13.4	273.	0.	10.0	0.	29.4	29.4	0.	0.41
17-0430	2.5	12.4	13.9	253.	0.	10.0	0.	29.4	29.4	0.	0.40
17-0530	2.5	12.4	13.9	239.	0.	10.0	0.	29.4	29.4	0.	0.40
17-0630	2.2	13.0	14.1	243.	0.	10.0	0.	29.4	29.4	0.	0.51
17-0730	2.2	12.7	14.1	263.	0.	10.0	0.	29.3	29.3	0.	0.47
17-0830	3.0	12.4	13.5	273.	0.	10.0	0.	29.4	29.4	0.	0.41
17-0930	2.9	12.7	13.5	212.	0.	10.0	0.	17.5	29.0	2.00	0.73
17-1030	3.6	12.9	12.8	152.	0.	10.0	0.	29.0	19.0	1.33	1.42
17-1130	4.1	14.0	12.6	132.	0.	10.0	1.5	19.0	19.0	1.28	1.66
17-1230	2.5	12.7	13.8	107.	0.	4.9	9.0	19.0	19.0	1.26	1.37
17-1330	2.1	13.2	14.0	116.	0.	7.4	7.4	19.0	19.0	1.24	1.40
17-1430	2.5	13.2	13.8	140.	0.	7.4	7.8	19.3	19.3	0.99	1.22
17-1530	2.4	13.2	13.8	142.	0.	7.2	7.6	29.3	29.3	0.23	0.50
17-1630	2.8	13.2	13.6	142.	0.	6.2	7.6	29.3	29.3	0.13	0.51
17-1730	2.5	13.0	13.8	146.	0.	5.4	8.4	29.2	29.2	0.07	0.56

SHUT DOWN AT 17-1730 FOR 3 HOURS

17-2030	2.5	13.2	13.4	152.	0.10	6.3	6.6	29.4	29.6	0.	0.42
17-2130	2.5	13.2	13.8	152.	0.10	6.1	7.4	29.4	29.4	0.	0.43
17-2230	3.5	12.4	13.1	160.	0.	10.0	6.0	29.4	29.4	0.	0.43
17-2330	4.0	12.2	12.7	164.	0.10	7.2	6.6	29.4	29.4	0.	0.45
18-0030	3.6	12.2	12.8	178.	0.20	7.4	6.2	29.2	29.2	0.	0.53
18-0130	3.5	12.4	13.1	199.	0.10	6.3	6.2	29.2	29.2	0.	0.57
18-0230	3.2	12.4	13.3	209.	0.10	7.2	5.5	29.3	29.3	0.	0.40
18-0330	3.2	12.4	13.3	204.	0.10	8.1	5.8	29.3	29.3	0.	0.40
18-0430	3.2	12.7	13.3	209.	0.10	9.6	5.6	29.4	29.4	0.	0.43
18-0530	3.5	12.2	13.1	192.	0.10	4.3	2.7	29.4	29.4	0.	0.40
18-0630	4.0	12.8	12.7	178.	0.10	10.0	5.0	29.3	29.3	0.	0.50
18-0730	3.6	12.4	13.0	176.	0.10	9.6	6.0	29.4	29.4	0.	0.43
18-0830	3.8	14.0	12.9	172.	0.20	6.9	6.6	29.4	29.4	0.	0.42

APPENDIX D: TABLE 4.

RUN 8: GAS COMPOSITIONS PAGE 7 OF 9

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
18-0930	3.9	12.2	12.8	150.	0.	7.4	7.0	20.4	20.4	0.	0.03
18-1030	2.9	12.7	13.5	172.	0.10	4.9	6.2	20.4	20.4	0.	0.02
18-1130	2.4	13.0	13.5	200.	0.10	9.2	6.6	20.4	20.4	0.	0.03
18-1230	3.2	12.7	13.3	196.	0.10	10.0	3.7	20.4	20.4	0.	0.03
18-1330	3.6	12.7	13.0	192.	0.20	10.9	5.4	20.4	20.4	0.	0.04
18-1430	3.2	12.7	13.3	172.	0.20	8.8	5.4	20.4	20.4	0.	0.03
18-1530	3.5	12.7	13.0	162.	0.09	6.3	5.6	20.4	20.4	0.	0.04
18-1630	3.5	12.4	13.1	150.	0.20	5.7	5.6	20.4	20.4	0.	0.03
18-1730	2.6	13.2	13.7	188.	0.50	5.9	5.6	20.4	20.4	0.	0.03
18-1830	2.6	13.2	13.7	196.	0.50	4.3	6.6	20.4	20.4	0.	0.03
18-1930	2.5	13.2	13.8	200.	0.40	4.4	5.2	20.4	20.4	0.	0.03
18-2030	2.6	13.2	13.7	226.	0.40	5.8	5.6	20.4	20.4	0.	0.03
18-2130	2.8	13.2	13.6	202.	0.40	7.2	5.4	20.4	20.4	0.	0.04
18-2230	2.6	13.2	13.7	198.	0.40	7.5	5.4	20.4	20.4	0.	0.03
18-2330	2.5	13.2	13.8	202.	0.40	7.8	5.2	20.4	20.4	0.	0.03
19-0030	2.5	13.2	13.9	196.	0.40	5.5	5.0	20.4	20.4	0.	0.03
19-0130	3.0	13.0	13.4	194.	0.40	5.5	5.4	20.4	20.4	0.	0.03
19-0230	2.9	13.2	13.5	190.	0.40	6.5	5.2	20.4	20.4	0.	0.04
19-0330	2.4	13.5	13.8	188.	0.40	9.6	5.0	20.4	20.4	0.	0.04
19-0430	2.9	13.1	13.5	186.	0.10	9.4	4.9	20.4	20.4	0.	0.03
19-0530	3.1	13.0	13.3	186.	0.10	10.0	4.6	20.4	20.4	0.	0.03
19-0630	4.0	12.7	12.7	157.	0.09	9.6	4.6	20.4	20.4	0.	0.05
19-0730	3.5	12.7	13.1	152.	0.30	6.7	5.3	20.4	20.4	0.	0.04
19-0830	3.7	12.4	13.0	140.	0.10	10.0	5.8	20.4	20.4	0.	0.03
19-0930	3.-	12.4	12.9	142.	0.16	10.0	4.2	20.4	20.4	0.	0.03
19-1030	4.1	12.2	12.6	134.	0.10	10.0	3.9	20.2	20.2	0.	0.30
19-1130	3.0	12.7	13.4	170.	0.10	9.4	5.8	20.4	20.4	0.	0.02
19-1230	3.0	12.7	13.4	136.	0.10	8.5	5.0	20.4	20.4	0.	0.02

19-1330	3-2	12-2	13-3	159.	4.00	1-5	4-2	20-4	20-4	0.	0-40
19-1430	2-8	12-4	13-5	156.	0.	10-0	0-7	18-6	18-6	1-01	1-44
19-1530	2-8	13-0	13-5	165.	0.	10-0	0-7	18-4	18-4	0.99	1-05
19-1630	2-8	12-7	13-5	166.	0.	10-0	0-3	18-6	18-6	0.99	1-67
19-1730	3-0	12-4	13-0	172.	0.	10-0	2-0	19-1	19-1	0.72	1-37

SHUT DOWN AT 19-1730 FOR 36 HOURS

21-0630	2-9	14-1	13-6	1000.	2-00	0-5	4-0	28-6	28-6	0.	0-30
21-0730	2-3	14-4	14-0	478.	0-80	1-7	7-2	28-6	28-6	0.	0-30
21-0830	2-3	14-4	14-0	366.	0-80	6-4	6-6	28-6	28-6	0.	0-30
21-0930	3-1	14-4	13-4	353.	0-60	4-9	7-4	28-6	28-6	0.	0-30
21-1030	3-4	14-4	13-2	363.	0-40	4-1	7-6	28-4	28-4	0.	0-40
21-1130	4-0	14-4	12-7	380.	0-40	5-4	7-4	28-4	28-4	0.	0-40
21-1230	4-9	15-0	13-0	385.	0-40	7-5	7-2	28-6	28-6	0.	0-34
21-1330	2-4	14-1	13-9	380.	0-30	7-2	7-0	28-3	28-3	0.	0-45
21-1430	3-2	13-8	13-3	378.	0-20	10-0	5-0	28-3	28-3	0.	0-53
21-1530	3-0	13-8	13-4	366.	0-10	10-0	5-2	28-4	28-4	0.	0-46
21-1630	2-8	14-1	12-6	364.	0-10	10-0	5-6	28-3	28-3	0.	0-54
21-1730	2-8	14-1	12-6	360.	0-20	10-0	5-6	28-3	28-3	0.	0-54
21-1830	2-8	14-1	13-6	358.	0-20	10-0	5-4	28-3	28-3	0.	0-54
21-1930	2-4	14-1	13-5	356.	0-20	10-0	4-6	28-3	28-3	0.	0-54
21-2030	4-0	13-5	12-7	325.	0-50	10-0	3-5	28-3	28-3	0.	0-54
21-2130	3-1	13-8	13-3	279.	0-70	8-1	5-4	28-3	28-3	0.	0-56
21-2230	2-9	13-8	13-5	303.	0-70	5-2	6-2	28-5	28-5	0.	0-30
21-2330	2-8	14-4	13-6	327.	0-50	5-3	6-5	28-5	28-5	0.	0-30
22-0030	2-6	14-4	13-7	313.	0-40	5-7	7-0	28-5	28-5	0.	0-30
22-0130	2-5	14-4	13-6	317.	0-60	4-1	6-6	28-5	28-5	0.	0-30
22-0230	2-5	14-7	13-8	324.	0-80	3-1	6-6	28-5	28-5	0.	0-30
22-0330	2-7	14-7	13-7	323.	0-80	3-3	6-2	28-5	28-5	0.	0-40
22-0430	2-3	14-4	14-0	316.	0-80	3-6	5-8	28-5	28-5	0.	0-40
22-0530	2-2	14-7	14-1	334.	0-80	3-3	5-4	28-5	28-5	0.	0-30
22-0630	2-2	14-7	14-1	334.	0-70	3-5	6-6	28-5	28-5	0.	0-30
22-0730	6-1	14-7	14-2	344.	0-80	3-5	6-8	28-5	28-5	0.	0-30
22-0830	2-8	15-0	14-2	356.	0-90	4-6	6-4	28-5	28-5	0.	0-30

APPENDIX F: TABLE V.

RUN 8: GAS COMPOSITIONS PAGE 8 OF 8

DAY.HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
07.0930	0.5	15.0	15.9	370.	0.50	4.1	6.2	20.7	20.7	0.	0.24
07.1030	1.9	15.0	14.3	415.	0.40	3.1	7.0	20.7	20.7	0.	0.24
07.1130	0.1	15.0	14.0	397.	0.40	2.5	5.0	20.7	20.7	0.	0.21
08.1030	0.1	15.3	14.2	364.	0.40	3.7	6.0	20.6	20.6	0.	0.30
08.1330	0.1	15.0	14.3	346.	0.40	1.9	6.2	20.7	20.7	0.	0.24

APPENDIX B. TABLE VI.

RUN 8: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 1 OF 8

DAY-HOUR	TOTAL SULPHUR KILOMOLS					EQUIVALENT BURNT STONE KILOGRAMS		
	IN	FLUE	REGEN	FINES	IN-OUT	FEED	REMOVED	IN-OUT
1-0330	0.112	0.035	0.021	0.002	0.053	5.4	1.8	3.6
1-0430	0.224	0.067	0.072	0.004	0.082	17.5	3.6	13.9
1-0530	0.337	0.092	0.128	0.005	0.112	32.8	5.3	27.5
1-0630	0.450	0.116	0.193	0.007	0.134	47.4	7.1	40.3
1-0730	0.563	0.137	0.261	0.009	0.156	61.7	8.7	53.0
1-0830	0.675	0.157	0.330	0.010	0.178	75.2	10.0	65.2
1-0930	0.788	0.178	0.385	0.011	0.213	88.6	11.4	77.3
1-1030	0.901	0.199	0.425	0.022	0.255	105.9	21.6	84.3
1-1130	1.014	0.217	0.459	0.023	0.316	125.0	24.9	100.1
1-1230	1.129	0.234	0.495	0.028	0.371	142.2	27.3	114.9
1-1330	1.244	0.250	0.540	0.035	0.419	164.1	32.8	131.3
1-1430	1.356	0.266	0.585	0.041	0.465	181.1	38.2	142.9
1-1530	1.469	0.281	0.627	0.046	0.515	197.8	42.0	155.8
1-1630	1.583	0.295	0.660	0.047	0.582	218.5	43.8	174.7
1-1730	1.692	0.309	0.690	0.048	0.645	241.4	44.9	196.5
1-1830	1.809	0.323	0.714	0.049	0.723	264.6	46.0	218.6
1-1930	1.922	0.336	0.785	0.051	0.750	287.4	47.1	240.3
1-2030	2.035	0.350	0.847	0.052	0.787	306.6	48.1	258.5
1-2130	2.148	0.363	0.924	0.053	0.808	323.8	49.2	274.6
1-2230	2.259	0.377	1.017	0.068	0.797	338.4	63.8	274.6
1-2330	2.370	0.390	1.115	0.070	0.794	352.7	64.9	287.8
2-0030	2.484	0.404	1.219	0.074	0.787	364.4	69.5	294.9
2-0130	2.596	0.417	1.339	0.076	0.763	382.1	70.6	311.5
2-0230	2.703	0.431	1.477	0.083	0.712	398.2	76.3	321.9
2-0330	2.816	0.442	1.609	0.086	0.679	418.7	78.8	339.9
2-0430	2.911	0.453	1.722	0.091	0.644	444.6	82.9	361.7
2-0530	3.018	0.466	1.842	0.106	0.604	466.5	93.7	372.8
2-0630	3.124	0.477	1.947	0.148	0.552	484.4	127.5	356.9

2-0730	3-228	0-489	2-046	0-173	0-578	500-6	145-9	354-7
2-0830	3-337	0-500	2-161	0-181	0-494	514-1	151-8	368-3
2-0930	3-446	0-512	2-293	0-183	0-438	528-9	157-8	376-1
2-1030	3-555	0-523	2-400	0-189	0-425	544-5	159-4	385-4
2-1130	3-664	0-534	2-481	0-192	0-437	562-7	160-5	400-8
2-1230	3-773	0-545	2-561	0-194	0-473	575-6	163-6	406-8
2-1330	3-883	0-557	2-640	0-202	0-475	590-3	178-6	419-8
2-1430	3-993	0-570	2-742	0-212	0-488	607-8	179-7	427-3
2-1530	4-103	0-583	2-815	0-217	0-489	629-7	184-4	445-3
2-1630	4-208	0-599	2-890	0-222	0-495	646-9	185-9	457-8
2-1730	4-318	0-616	2-947	0-230	0-504	663-9	190-2	465-7
2-1830	4-427	0-636	3-022	0-236	0-533	678-7	204-8	474-7
2-1930	4-535	0-658	3-099	0-252	0-505	693-5	218-8	475-5
2-2030	4-644	0-678	3-161	0-258	0-505	705-1	224-8	478-1
2-2130	4-752	0-695	3-247	0-269	0-540	722-4	235-4	477-8
2-2230	4-862	0-713	3-302	0-282	0-564	740-8	247-8	482-1
2-2330	4-969	0-733	3-356	0-291	0-584	774-9	260-8	518-1
3-0030	5-082	0-752	3-409	0-317	0-593	788-8	283-4	506-5
3-0130	5-181	0-773	3-475	0-327	0-626	795-7	272-7	502-8
3-0230	5-326	0-796	3-525	0-338	0-667	808-3	305-8	502-3
3-0330	5-456	0-819	3-601	0-348	0-685	819-9	316-4	720-5
3-0430	5-589	0-840	3-666	0-350	0-717	829-3	327-8	581-5
3-0530	5-722	0-862	3-731	0-369	0-728	837-7	339-6	498-8
3-0630	5-855	0-919	3-812	0-389	0-736	846-8	350-3	486-7
3-0730	5-989	0-962	3-884	0-399	0-744	852-7	373-2	488-5
3-0830	6-123	1-010	3-993	0-407	0-713	856-5	389-5	476-8
3-0930	6-257	1-071	4-088	0-413	0-695	862-7	387-2	475-5
3-1030	6-379	1-123	4-180	0-420	0-657	868-7	394-8	475-8
3-1130	6-494	1-161	4-254	0-426	0-645	874-3	400-7	473-6
3-1230	6-619	1-199	4-347	0-438	0-634	881-8	405-4	475-6
3-1330	6-726	1-233	4-425	0-445	0-629	894-3	415-2	476-8
3-1430	6-845	1-262	4-511	0-447	0-625	913-6	420-8	490-8
3-1530	6-958	1-288	4-589	0-450	0-639	929-8	423-5	506-3
3-1630	7-075	1-313	4-657	0-456	0-640	946-9	428-4	518-5
3-1730	7-185	1-335	4-737	0-463	0-649	963-5	431-7	526-8
3-1830	7-300	1-364	4-891	0-471	0-653	978-7	447-8	530-7

APPENDIX P: TABLE VI.
RUN 6: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 2 OF 4

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
3-1930	7-484	1-391	4-897	0-479	0-657	1001-2	455-2	546-0
3-2030	7-537	1-416	4-978	0-487	0-655	1021-4	462-5	558-9
3-2130	7-654	1-441	5-056	0-498	0-638	1043-5	475-6	567-9
3-2230	7-773	1-468	5-146	0-511	0-640	1061-6	488-5	573-1
3-2330	7-886	1-490	5-229	0-531	0-625	1083-9	509-5	574-4
4-0030	7-999	1-509	5-322	0-556	0-613	1088-0	530-3	557-7
4-0130	8-115	1-526	5-416	0-560	0-612	1105-5	525-1	578-4
4-0230	8-230	1-544	5-494	0-565	0-627	1128-0	539-9	588-1
4-0330	8-346	1-563	5-570	0-600	0-613	1143-7	562-7	581-0
4-0430	8-461	1-580	5-650	0-605	0-626	1167-7	567-7	600-0
4-0530	8-575	1-596	5-712	0-610	0-635	1192-0	573-4	618-6
4-0630	8-687	1-611	5-775	0-616	0-626	1201-7	579-1	622-6
4-0730	8-801	1-629	5-860	0-622	0-691	1207-7	584-0	623-7
4-0830	8-910	1-647	5-946	0-632	0-686	1219-5	594-7	624-8
4-0930	9-024	1-666	6-025	0-677	0-646	1233-2	631-7	601-5
4-1030	9-134	1-684	6-121	0-682	0-647	1238-3	636-3	602-0
4-1130	9-245	1-704	6-214	0-687	0-640	1240-9	640-9	600-0
4-1230	9-357	1-727	6-313	0-691	0-626	1246-9	644-4	602-5
4-1330	9-467	1-750	6-413	0-693	0-611	1253-7	646-8	606-9
4-1430	9-582	1-774	6-519	0-696	0-599	1262-3	649-4	612-9
4-1530	9-694	1-798	6-593	0-699	0-603	1270-6	651-0	619-6
4-1630	9-806	1-822	6-682	0-701	0-601	1278-2	653-9	624-3
4-1730	9-916	1-846	6-773	0-704	0-596	1286-5	655-8	630-7
4-1830	10-031	1-870	6-860	0-706	0-595	1297-1	657-8	639-3
4-1930	10-143	1-893	6-951	0-720	0-581	1305-5	668-7	636-8
4-2030	10-256	1-915	7-046	0-725	0-567	1314-9	675-2	639-7
4-2130	10-369	1-937	7-137	0-732	0-563	1324-3	678-3	646-0
4-2230	10-481	1-958	7-217	0-736	0-570	1333-2	682-1	651-1

4-2330	10-594	1-979	7-292	8-745	8-577	1340-2	688-7	651-4
5-0030	10-706	1-999	7-377	8-753	8-576	1347-7	697-1	658-6
5-0130	10-819	2-019	7-459	8-759	8-582	1356-3	700-9	655-4
5-0230	10-932	2-038	7-538	8-763	8-593	1364-4	704-5	639-8
5-0330	11-044	2-058	7-643	8-767	8-576	1370-8	708-8	642-9
5-0430	11-157	2-078	7-731	8-771	8-576	1378-4	711-4	667-8
5-0530	11-269	2-097	7-815	8-774	8-582	1387-0	713-9	673-2
5-0630	11-382	2-116	7-898	8-777	8-588	1395-1	716-2	670-8
5-0730	11-494	2-136	7-973	8-782	8-604	1401-1	719-6	681-5
5-0830	11-607	2-155	8-063	8-893	8-585	1407-8	726-1	672-6

SHUT DOWN AT 5-0830 FOR 3 HOURS

5-1130	11-720	2-191	8-151	8-809	8-578	1410-8	740-4	678-4
5-1230	11-835	2-207	8-239	8-817	8-572	1417-8	745-6	678-1
5-1330	11-949	2-234	8-325	8-824	8-566	1423-4	750-7	678-0
5-1430	12-062	2-260	8-423	8-831	8-547	1428-3	756-0	678-3
5-1530	12-175	2-286	8-518	8-833	8-538	1432-3	757-4	674-9
5-1630	12-288	2-311	8-607	8-834	6-536	1438-5	758-4	688-1
5-1730	12-401	2-336	8-695	8-835	8-535	1445-5	759-3	686-2
5-1830	12-513	2-360	8-781	8-837	8-536	1451-7	760-2	691-5
5-1930	12-618	2-381	8-860	8-838	8-539	1456-6	761-4	695-1
5-2030	12-723	2-405	8-941	8-840	8-538	1460-6	762-7	697-9
5-2130	12-827	2-430	9-019	8-842	8-577	1464-4	764-1	700-3
5-2230	12-932	2-455	9-100	8-843	8-532	1470-8	765-5	704-5
5-2330	13-037	2-478	9-176	8-845	8-539	1476-8	766-9	709-9
6-0030	13-142	2-502	9-252	8-847	8-541	1482-0	768-3	714-7
6-0130	13-246	2-523	9-326	8-850	8-539	1489-4	777-8	711-6
6-0230	13-351	2-545	9-402	8-861	8-542	1492-9	779-6	713-3
6-0330	13-456	2-570	9-467	8-864	8-553	1497-5	781-6	716-2
6-0430	13-562	2-595	9-538	8-867	8-562	1515-0	783-2	721-8
6-0530	13-667	2-617	9-605	8-892	8-552	1518-5	875-8	714-7
6-0630	13-772	2-640	9-672	8-894	8-566	1525-3	885-0	739-5
6-0730	13-877	2-663	9-742	8-895	8-574	1532-3	887-9	724-4
6-0830	13-982	2-686	9-824	8-899	8-573	1539-8	889-0	730-9

APPENDIX B: TABLE VI.

RUN 6: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 3 OF 4

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	RESID	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
6-0930	14.087	2.709	9.905	0.907	0.566	1548.2	814.6	733.6
6-1030	14.192	2.733	9.981	0.914	0.564	1558.9	819.9	739.0
6-1130	14.298	2.756	10.063	0.925	0.554	1557.6	827.9	729.7
6-1230	14.405	2.779	10.140	0.933	0.553	1564.6	833.6	731.0
6-1330	14.514	2.801	10.222	0.942	0.549	1570.1	838.4	731.7
6-1430	14.616	2.822	10.288	0.951	0.554	1576.5	845.9	730.6
6-1530	14.721	2.843	10.363	0.960	0.554	1581.0	851.6	729.4
6-1630	14.826	2.865	10.439	0.970	0.551	1587.5	857.9	729.6
6-1730	14.931	2.888	10.512	0.975	0.556	1595.1	861.7	733.4
6-1830	15.037	2.911	10.587	0.985	0.554	1598.0	868.8	729.2
6-1930	15.142	2.933	10.661	0.995	0.552	1603.1	876.2	726.9
6-2030	15.247	2.957	10.745	1.002	0.543	1609.6	882.2	727.4
6-2130	15.352	2.980	10.795	1.006	0.570	1615.5	888.1	727.4
6-2230	15.458	3.002	10.878	1.012	0.565	1621.5	894.1	727.4
6-2330	15.564	3.024	10.962	1.020	0.558	1630.3	903.4	726.9
7-0030	15.669	3.046	11.044	1.024	0.555	1638.5	905.4	733.1
7-0130	15.775	3.066	11.125	1.027	0.556	1647.6	915.5	732.1
7-0230	15.880	3.086	11.203	1.031	0.560	1657.3	921.5	735.8
7-0330	15.985	3.105	11.277	1.036	0.567	1666.7	927.5	739.2
7-0430	16.090	3.124	11.352	1.041	0.574	1673.8	933.5	740.3
7-0530	16.197	3.143	11.418	1.054	0.582	1681.3	945.4	735.9
7-0630	16.303	3.161	11.498	1.060	0.584	1687.7	952.0	735.7
7-0730	16.408	3.180	11.579	1.069	0.580	1694.2	960.3	733.9
7-0830	16.513	3.199	11.660	1.079	0.575	1700.9	968.5	732.4
7-0930	16.619	3.220	11.747	1.089	0.563	1708.5	976.4	732.1
7-1030	16.724	3.244	11.826	1.096	0.558	1715.8	982.8	733.0
7-1130	16.830	3.268	11.897	1.110	0.555	1724.9	993.6	731.3
7-1230	16.934	3.290	11.969	1.119	0.556	1730.6	1000.0	730.6

7-1330	17-041	3-312	12-052	1-128	0-540	1725-2	1004-4	728-8
7-1430	17-146	3-333	12-130	1-137	0-555	1739-7	1012-7	727-1
7-1530	17-251	3-354	12-190	1-147	0-560	1746-2	1018-8	727-4
7-1630	17-356	3-379	12-267	1-157	0-554	1752-9	1024-8	728-1
7-1730	17-462	3-409	12-331	1-173	0-548	1761-8	1035-5	725-6
7-1830	17-567	3-442	12-401	1-184	0-540	1770-2	1040-5	729-7
7-1930	17-672	3-481	12-468	1-194	0-529	1778-5	1047-1	731-5
7-2030	17-777	3-507	12-535	1-204	0-531	1785-5	1052-4	733-1
7-2130	17-883	3-535	12-603	1-214	0-530	1793-1	1057-8	735-3
7-2230	17-987	3-562	12-670	1-223	0-532	1799-2	1062-9	732-3
7-2330	18-093	3-591	12-738	1-237	0-536	1804-4	1073-2	731-2
8-0030	18-198	3-624	12-784	1-247	0-543	1811-9	1078-7	733-2
8-0130	18-302	3-653	12-843	1-256	0-550	1818-9	1084-5	734-5
8-0230	18-411	3-679	12-903	1-266	0-563	1826-2	1090-3	736-8
8-0330	18-515	3-704	12-963	1-276	0-572	1832-2	1096-0	737-2
8-0430	18-620	3-729	13-024	1-286	0-583	1840-8	1101-8	739-8
8-0530	18-726	3-754	13-093	1-307	0-573	1848-2	1116-0	732-3
8-0630	18-832	3-779	13-154	1-317	0-583	1855-1	1121-9	732-1
8-0730	18-937	3-804	13-220	1-326	0-587	1860-7	1127-8	732-9
8-0830	19-042	3-834	13-281	1-335	0-592	1866-4	1133-7	732-7
8-0930	19-147	3-865	13-341	1-344	0-592	1869-9	1139-6	730-3
8-1030	19-253	3-896	13-413	1-352	0-593	1872-9	1145-4	726-6
8-1130	19-358	3-927	13-483	1-354	0-594	1877-1	1146-8	730-3
8-1230	19-463	3-959	13-548	1-368	0-592	1880-1	1150-8	721-4
8-1330	19-568	3-990	13-614	1-369	0-594	1883-6	1159-8	723-8
8-1430	19-673	4-024	13-684	1-371	0-594	1888-2	1160-8	727-6
8-1530	19-778	4-058	13-754	1-375	0-591	1889-3	1163-2	726-1
8-1630	19-883	4-095	13-818	1-376	0-594	1896-0	1164-2	731-8
8-1730	19-989	4-127	13-876	1-393	0-593	1901-9	1176-1	725-9
8-1830	20-094	4-157	13-944	1-402	0-586	1907-6	1183-8	721-8
8-1930	20-200	4-189	14-010	1-420	0-572	1913-2	1190-5	714-7
8-2030	20-306	4-226	14-074	1-438	0-567	1920-0	1203-9	716-1
8-2130	20-412	4-266	14-131	1-440	0-564	1926-5	1209-3	717-9
8-2230	20-517	4-305	14-192	1-450	0-561	1933-5	1214-7	718-8
8-2330	20-623	4-340	14-245	1-470	0-557	1938-8	1220-7	716-9
9-0030	20-729	4-380	14-305	1-480	0-554	1943-4	1229-0	715-5

APPENDIX F: TABLE VI.

RUN 8: SULPHUR AND STONE CUMULATIVE BALANCES. PAGE 4 OF 8

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
9-0130	20.834	4.430	14.368	1.482	0.555	1948.0	1233.2	714.8
9-0230	20.940	4.470	14.425	1.488	0.556	1952.6	1238.4	714.2
9-0330	21.045	4.511	14.471	1.508	0.555	1955.1	1243.7	711.4
9-0430	21.151	4.549	14.531	1.517	0.554	1963.9	1248.9	715.0
9-0530	21.257	4.586	14.592	1.535	0.544	1969.8	1260.6	709.2
9-0630	21.362	4.621	14.647	1.544	0.550	1976.0	1265.8	710.2
9-0730	21.468	4.655	14.709	1.554	0.550	1982.2	1271.1	711.1
9-0830	21.574	4.687	14.768	1.563	0.556	1990.9	1276.3	714.6
9-0930	21.679	4.720	14.828	1.572	0.558	1994.1	1281.5	712.6
9-1030	21.784	4.754	14.897	1.590	0.543	1999.2	1292.8	706.4
9-1130	21.889	4.791	14.962	1.611	0.525	2000.8	1304.6	696.2
9-1230	21.995	4.833	15.020	1.627	0.515	2004.5	1317.1	687.4
9-1330	22.101	4.874	15.076	1.635	0.516	2011.3	1321.7	689.6
9-1430	22.207	4.916	15.130	1.657	0.505	2017.2	1337.1	680.1
9-1530	22.313	4.957	15.178	1.666	0.513	2026.4	1341.8	684.6
9-1630	22.419	4.999	15.232	1.680	0.508	2034.2	1350.8	683.4
9-1730	22.524	5.042	15.285	1.689	0.508	2037.2	1355.6	681.6
9-1830	22.630	5.090	15.328	1.700	0.512	2044.5	1360.8	683.7
9-1930	22.736	5.127	15.386	1.717	0.503	2053.4	1371.1	682.3
9-2030	22.842	5.166	15.438	1.729	0.509	2060.1	1376.6	683.5
9-2130	22.948	5.207	15.490	1.740	0.511	2065.5	1382.2	683.3
9-2230	23.053	5.245	15.540	1.742	0.525	2070.8	1383.3	687.5

SHUT DOWN AT 9-2230 FOR 23 HOURS

DAY-HOUR	IN	FLUE	REGEN	FINES	IN-OUT	FEED	REMOVED	IN-OUT
10-2230	-	-	-	-	-	2089.5	1394.5	695.0
10-2330	23.167	5.274	15.576	1.748	0.569	2088.1	1388.3	699.8
11-0030	23.285	5.305	15.627	1.751	0.602	2096.7	1389.8	706.9
11-0130	23.405	5.337	15.676	1.755	0.637	2107.5	1391.8	715.7
11-0230	23.526	5.365	15.724	1.769	0.668	2119.6	1399.9	719.6

11-0330	23.647	5.392	15.799	1.772	0.604	2125.6	1402.0	723.6
11-0430	23.767	5.408	15.888	1.776	0.651	2131.0	1404.1	726.9
11-0530	23.889	5.459	15.960	1.782	0.697	2136.1	1407.6	728.5
11-0630	23.911	5.482	16.042	1.794	0.694	2142.3	1414.6	727.6
11-0730	24.103	5.507	16.123	1.796	0.676	2148.5	1415.0	730.7

SHUT DOWN AT 11-0730 FOR 19 HOURS

12-0330	-	-	-	-	-	2154.4	1425.8	726.6
12-0430	-	-	-	-	-	2161.4	1431.2	730.2
12-0530	-	-	-	-	-	2170.3	1435.0	735.3
12-0630	-	-	-	-	-	2177.3	1435.8	741.5
12-0730	-	-	-	-	-	2182.1	1436.3	745.6
12-0830	24.211	5.599	16.131	1.797	0.684	2187.3	1436.8	750.5
12-0930	24.319	5.692	16.144	1.798	0.686	2194.5	1437.3	757.2
12-1030	24.429	5.774	16.144	1.799	0.711	2202.4	1437.8	764.5
12-1130	24.539	5.845	16.144	1.805	0.744	2210.4	1442.0	777.5
12-1230	24.647	5.911	16.160	1.807	0.770	2220.1	1443.7	786.4
12-1330	24.756	5.976	16.176	1.808	0.797	2230.5	1444.8	793.6
12-1430	24.865	6.040	16.176	1.817	0.821	2251.7	1450.3	801.4
12-1530	24.976	6.126	16.175	1.830	0.844	2265.9	1455.7	810.2
12-1630	25.085	6.202	16.203	1.850	0.830	2270.3	1465.5	819.0
12-1730	25.210	6.291	16.241	1.871	0.816	2292.3	1475.4	817.0
12-1830	25.342	6.342	16.253	1.891	0.856	2305.0	1485.1	819.9
12-1930	25.461	6.375	16.306	1.911	0.869	2320.9	1494.7	826.2
12-2030	25.576	6.402	16.363	1.931	0.882	2332.0	1504.6	828.4
12-2130	25.697	6.423	16.422	1.952	0.895	2347.0	1514.8	833.0
12-2230	25.814	6.452	16.486	1.979	0.901	2358.5	1523.7	835.2
12-2330	25.931	6.476	16.555	1.995	0.906	2367.2	1536.8	831.3
13-0030	26.051	6.498	16.632	2.005	0.912	2375.6	1545.7	829.6
13-0130	26.169	6.520	16.716	2.023	0.909	2386.6	1555.2	831.4
13-0230	26.286	6.541	16.788	2.025	0.932	2398.4	1556.0	842.0

APPENDIX F: TABLE VI.

RUN 6: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 5 OF 8

	TOTAL SULPHUR KILOMOLS					EQUIVALENT BURNT STONE KILOGRAMS		
DAY-HOUR	IN	FLUE	MIXED	FINES	IN-OUT	FEED	REMOVED	IN-OUT
13-0330	26.400	6.580	16.852	2.032	0.940	2407.9	1561.0	846.0
13-0430	26.527	6.610	16.981	2.047	0.940	2418.4	1570.7	847.7
13-0530	26.656	6.656	16.992	2.066	0.939	2428.9	1582.7	845.8
13-0630	26.789	6.706	17.064	2.081	0.922	2439.5	1593.4	846.1
13-0730	26.907	6.755	17.155	2.096	0.901	2446.4	1603.1	846.3
13-0830	27.033	6.806	17.236	2.112	0.888	2457.2	1612.0	844.4
13-0930	27.160	6.859	17.309	2.127	0.865	2468.1	1622.5	839.6
13-1030	27.289	6.913	17.369	2.143	0.864	2474.2	1630.2	840.0
13-1130	27.415	6.963	17.427	2.158	0.857	2489.8	1640.9	847.1
13-1230	27.543	7.015	17.488	2.174	0.855	2500.5	1651.6	838.9
13-1330	27.671	7.068	17.548	2.199	0.863	2517.3	1670.1	847.2
13-1430	27.798	7.117	17.595	2.216	0.870	2525.9	1680.2	845.7
13-1530	27.926	7.168	17.652	2.233	0.871	2538.3	1690.4	848.0
13-1630	28.052	7.218	17.705	2.250	0.876	2551.5	1702.5	851.0
13-1730	28.181	7.265	17.760	2.271	0.885	2565.5	1714.0	851.6
13-1830	28.309	7.311	17.820	2.288	0.890	2578.2	1723.0	854.3
13-1930	28.436	7.356	17.894	2.305	0.892	2589.8	1733.7	856.1
13-2030	28.564	7.408	17.944	2.322	0.898	2605.4	1743.6	862.0
13-2130	28.691	7.445	18.009	2.332	0.900	2617.8	1753.2	864.6
13-2230	28.818	7.485	18.070	2.361	0.902	2631.3	1767.8	863.5
13-2330	28.946	7.527	18.128	2.379	0.912	2645.0	1777.8	867.3
14-0030	29.085	7.568	18.195	2.397	0.925	2657.4	1788.0	869.4
14-0130	29.219	7.608	18.269	2.414	0.936	2669.3	1798.3	871.0
14-0230	29.353	7.629	18.342	2.432	0.950	2681.9	1808.5	873.4
14-0330	29.485	7.656	18.415	2.449	0.966	2697.8	1818.6	879.2
14-0430	29.618	7.683	18.487	2.465	0.981	2710.8	1829.6	882.2
14-0530	29.751	7.708	18.568	2.486	0.987	2722.6	1843.6	879.1
14-0630	29.885	7.734	18.648	2.504	0.998	2732.9	1853.5	880.4

14-0730	29-917	7-761	18-787	2-521	1-800	2745-5	1863-3	889-1
14-0830	30-149	7-788	18-886	2-537	1-819	2756-6	1873-4	893-9
14-0930	30-281	7-815	18-888	2-553	1-826	2766-8	1883-3	882-5
14-1030	30-414	7-842	18-969	2-569	1-834	2778-4	1893-3	885-1
14-1130	30-546	7-869	19-048	2-588	1-841	2792-7	1905-8	887-7
14-1230	30-679	7-897	19-130	2-604	1-849	2805-6	1914-8	890-9
14-1330	30-811	7-925	19-212	2-619	1-855	2819-4	1924-5	894-9
14-1430	30-942	7-953	19-296	2-635	1-859	2830-1	1934-2	895-9
14-1530	31-073	7-979	19-377	2-650	1-867	2843-9	1943-9	900-8
14-1630	31-205	8-008	19-458	2-666	1-872	2858-7	1953-6	905-1
14-1730	31-337	8-038	19-544	2-689	1-825	2870-7	1956-3	914-4
14-1830	31-469	8-066	19-627	2-692	1-854	2884-2	1970-8	913-4
14-1930	31-601	8-094	19-717	2-715	1-875	2898-6	1985-6	912-7
14-2030	31-734	8-123	19-814	2-738	1-858	2912-3	2000-4	911-9
14-2130	31-866	8-153	19-908	2-755	1-851	2926-3	2010-3	915-5
14-2230	31-998	8-181	19-999	2-771	1-846	2941-1	2021-3	919-9
14-2330	32-131	8-210	20-089	2-803	1-808	2953-5	2043-9	909-6
15-0030	32-264	8-239	20-179	2-820	1-827	2965-9	2054-5	911-4
15-0130	32-398	8-267	20-272	2-837	1-821	2981-8	2065-3	916-5
15-0230	32-532	8-293	20-376	2-854	1-814	2993-4	2076-2	917-2
15-0330	32-666	8-317	20-463	2-871	1-814	3007-6	2087-8	920-6
15-0430	32-799	8-340	20-559	2-889	1-819	3025-2	2097-8	927-4
15-0530	32-933	8-366	20-642	2-912	1-814	3039-5	2113-0	926-4
15-0630	33-067	8-390	20-732	2-930	1-815	3048-9	2120-1	924-9
15-0730	33-200	8-413	20-821	2-934	1-832	3062-7	2126-4	934-1
15-0830	33-333	8-440	20-894	2-952	1-847	3075-6	2137-8	937-8
15-0930	33-466	8-470	20-979	2-970	1-849	3084-2	2140-8	935-8
15-1030	33-600	8-501	21-063	2-973	1-863	3096-6	2151-5	945-1
15-1130	33-732	8-532	21-142	2-984	1-873	3107-9	2159-3	946-6
15-1230	33-865	8-566	21-224	2-988	1-888	3123-3	2152-4	948-8
15-1330	33-999	8-597	21-299	2-993	1-119	3135-7	2166-3	949-4
15-1430	34-131	8-625	21-374	2-998	1-129	3142-2	2176-1	976-1
15-1530	34-263	8-659	21-446	3-003	1-154	3158-8	2173-9	984-9
15-1630	34-392	8-687	21-512	3-009	1-185	3173-1	2177-8	995-4
15-1730	34-520	8-713	21-585	3-020	1-203	3189-6	2185-9	1003-6
15-1830	34-648	8-737	21-656	3-039	1-214	3200-5	2197-9	1004-6

APPENDIX IV. TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 6 OF 8

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
15-1930	34.775	8.760	21.731	3.058	1.226	3215.7	2209.2	1006.5
15-2030	34.901	8.782	21.811	3.077	1.231	3227.5	2220.5	1007.0
15-2130	35.028	8.805	21.894	3.088	1.240	3239.9	2223.1	1016.8
15-2230	35.155	8.828	21.966	3.100	1.254	3253.4	2234.5	1019.0
15-2330	35.282	8.852	22.047	3.126	1.257	3263.6	2250.1	1013.5
16-0030	35.409	8.877	22.128	3.162	1.242	3273.1	2271.2	1001.9
16-0130	35.537	8.902	22.209	3.168	1.258	3289.8	2275.8	1013.9
16-0230	35.664	8.932	22.291	3.189	1.257	3303.3	2287.5	1015.7
16-0330	35.800	8.958	22.377	3.194	1.270	3318.9	2291.4	1027.5
16-0430	35.928	8.983	22.458	3.215	1.275	3331.0	2303.8	1027.2
16-0530	36.049	9.013	22.547	3.235	1.275	3344.5	2316.3	1028.2
16-0630	36.209	9.057	22.547	3.262	1.344	3356.1	2332.2	1023.9
16-0730	36.351	9.094	22.547	3.281	1.429	3366.0	2344.0	1022.0
16-0830	36.482	9.129	22.547	3.300	1.506	3377.6	2355.2	1022.4
16-0930	36.607	9.153	22.598	3.319	1.542	3385.7	2366.2	1019.5
16-1030	36.739	9.177	22.688	3.338	1.527	3393.2	2377.2	1016.0
16-1130	36.854	9.204	22.786	3.365	1.500	3402.4	2391.3	1011.1
16-1230	36.985	9.233	22.883	3.384	1.485	3414.3	2402.0	1012.3
16-1330	37.117	9.260	22.970	3.402	1.485	3425.6	2412.1	1013.5
16-1430	37.246	9.286	23.061	3.419	1.480	3438.0	2422.2	1015.8
16-1530	37.376	9.308	23.175	3.439	1.454	3449.0	2433.5	1015.5
16-1630	37.466	9.320	23.295	3.453	1.397	3459.3	2442.3	1016.9
16-1730	37.577	9.337	23.403	3.464	1.373	3464.6	2448.1	1016.6
16-1830	37.691	9.357	23.508	3.480	1.347	3473.8	2458.0	1015.8
16-1930	37.818	9.377	23.596	3.501	1.334	3484.8	2470.5	1013.6
16-2030	37.935	9.400	23.681	3.517	1.337	3494.8	2480.3	1013.8
16-2130	38.044	9.425	23.770	3.529	1.340	3500.6	2492.1	1008.5
16-2230	38.199	9.450	23.837	3.529	1.381	3512.6	2493.3	1019.3

16-2330	38-224	9-476	23-847	3-533	1-455	3508-4	2489-8	1849-0
17-0030	38-438	9-503	23-847	3-535	1-554	3513-1	2490-2	1855-9
17-0130	38-560	9-529	23-847	3-537	1-640	3559-5	2491-8	1861-7
17-0230	38-676	9-554	23-847	3-557	1-729	3578-2	2501-4	1870-3
17-0330	38-817	9-577	23-847	3-577	1-806	3587-5	2511-8	1875-7
17-0430	38-934	9-595	23-847	3-599	1-890	3597-5	2521-8	1875-7
17-0530	39-058	9-619	23-847	3-632	1-960	3606-8	2535-1	1873-7
17-0630	39-192	9-640	23-847	3-654	2-041	3620-6	2545-0	1875-7
17-0730	39-306	9-662	23-847	3-762	2-035	3629-3	2582-9	1846-1
17-0830	39-425	9-686	23-847	3-784	2-112	3635-8	2592-8	1846-9
17-0930	39-547	9-704	23-847	3-886	2-190	3651-1	2602-8	1848-3
17-1030	39-659	9-717	23-847	3-821	2-275	3660-5	2609-4	1851-4
17-1130	39-768	9-728	23-849	3-844	2-328	3670-5	2618-6	1851-5
17-1230	39-876	9-736	23-992	3-862	2-256	3681-9	2627-3	1853-7
17-1330	39-985	9-745	24-118	3-863	2-069	3695-8	2627-9	1867-1
17-1430	40-106	9-756	24-242	3-878	2-230	3705-8	2634-9	1870-9
17-1530	40-223	9-768	24-365	3-912	2-194	3716-6	2641-8	1874-2
17-1630	40-340	9-780	24-491	3-906	2-163	3729-8	2648-8	1881-0
17-1730	40-456	9-792	24-629	3-908	2-127	3734-6	2649-4	1895-2

SHUT DOWN AT 17-1730 FOR 3 HOURS

17-2037	40-573	9-884	24-749	3-921	2-105	3742-7	2656-4	1096-3
17-2130	40-695	9-917	24-838	3-922	2-117	3754-3	2657-1	1097-2
17-2230	40-819	9-831	24-927	3-924	2-109	3763-9	2657-7	1105-5
17-2330	40-921	9-845	25-032	3-929	2-115	3779-5	2649-1	1118-4
18-0030	41-031	9-859	25-130	3-932	2-110	3789-9	2661-5	1128-3
18-0130	41-142	9-875	25-225	3-935	2-107	3799-6	2663-7	1135-9
18-0230	41-256	9-892	25-321	3-939	2-104	3811-4	2665-9	1145-5
18-0330	41-369	9-909	25-412	3-942	2-106	3817-3	2668-1	1150-2
18-0430	41-482	9-926	25-501	3-946	2-110	3828-9	2670-3	1159-6
18-0530	41-594	9-942	25-532	3-962	2-158	3844-5	2678-5	1166-1
18-0630	41-704	9-956	25-619	3-973	2-163	3852-4	2684-5	1167-9
18-0730	41-813	9-971	25-709	3-983	2-151	3862-6	2690-1	1170-5
18-0830	41-923	9-985	25-810	3-992	2-136	3875-5	2695-7	1179-6

APPENDIX P: TABLE VI.

RUN No: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 7 OF 8

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	[illegible]	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	RESIDUE	IN-OUT
18-0930	42.032	9.997	25.042	4.007	2.084	3882.8	2705.6	1176.4
18-1030	42.145	10.011	26.018	4.021	2.112	3891.7	2707.0	1184.7
18-1130	42.259	10.025	26.096	4.037	2.100	3901.9	2720.4	1181.5
18-1230	42.374	10.044	26.139	4.053	2.137	3914.9	2730.6	1184.3
18-1330	42.487	10.059	26.229	4.066	2.127	3924.9	2738.7	1186.2
18-1430	42.598	10.073	26.321	4.083	2.112	3935.6	2749.0	1186.6
18-1530	42.695	10.086	26.415	4.099	2.055	3945.4	2759.3	1186.3
18-1630	42.804	10.098	26.507	4.231	1.969	3954.5	2812.6	1141.9
18-1730	42.915	10.113	26.587	4.247	1.972	3965.5	2823.6	1140.6
18-1830	43.032	10.128	26.686	4.275	1.945	3977.1	2836.8	1140.3
18-1930	43.145	10.145	26.768	4.289	1.943	3989.2	2847.2	1142.1
18-2030	43.257	10.163	26.859	4.304	1.930	4004.1	2857.5	1146.6
18-2130	43.367	10.179	26.948	4.320	1.921	4018.6	2867.7	1150.9
18-2230	43.477	10.193	27.034	4.336	1.915	4032.6	2878.0	1154.6
18-2330	43.588	10.209	27.118	4.359	1.902	4044.7	2891.7	1153.1
19-0030	43.699	10.224	27.198	4.376	1.908	4059.6	2902.7	1156.8
19-0130	43.809	10.240	27.276	4.382	1.911	4070.3	2906.0	1164.3
19-0230	43.919	10.255	27.356	4.389	1.919	4085.7	2909.3	1176.4
19-0330	44.031	10.269	27.438	4.395	1.929	4101.3	2912.5	1188.8
19-0430	44.142	10.284	27.514	4.401	1.943	4120.2	2915.8	1204.4
19-0530	44.259	10.299	27.592	4.442	1.929	4132.0	2934.3	1197.7
19-0630	44.357	10.312	27.632	4.453	1.948	4144.2	2939.8	1204.4
19-0730	44.464	10.324	27.722	4.479	1.948	4156.6	2947.4	1209.1
19-0830	44.571	10.335	27.808	4.487	1.941	4166.5	2955.1	1211.4
19-0930	44.683	10.347	27.879	4.505	1.961	4181.1	2962.7	1219.3
19-1030	44.789	10.358	27.917	4.517	1.967	4195.9	2968.6	1227.9
19-1130	44.895	10.367	28.016	4.545	1.979	4211.5	2981.7	1229.8
19-1230	45.003	10.377	28.100	4.553	1.979	4226.9	2985.5	1240.3

19-1330	45-195	10-389	28-161	4-538	1-999	4235-0	2987-8	1247-1
19-1430	45-214	10-401	28-171	4-563	2-079	4241-4	2990-7	1251-3
19-1530	45-308	10-414	28-180	4-568	2-150	4247-4	2992-5	1254-9
19-1630	45-426	10-426	28-195	4-574	2-041	4252-2	2994-8	1257-4
19-1730	45-539	10-440	28-216	4-578	2-096	4256-4	2997-8	1258-0

SHUT DOWN AT 19-1730 FOR 36 HOURS

21-0630	45-649	10-527	28-266	4-596	2-060	4267-8	3005-0	1262-8
21-0730	45-769	10-567	28-368	4-610	2-094	4274-3	3011-3	1263-8
21-0830	45-886	10-597	28-465	4-624	2-090	4280-3	3017-6	1262-9
21-0930	46-009	10-628	28-571	4-629	2-180	4286-2	3019-7	1266-5
21-1030	46-128	10-661	28-676	4-651	2-141	4292-6	3029-0	1268-7
21-1130	46-249	10-695	28-776	4-645	2-112	4302-0	3036-2	1265-9
21-1230	46-369	10-730	28-881	4-679	2-079	4310-1	3042-1	1268-0
21-1330	46-488	10-761	28-993	4-695	2-036	4315-8	3051-8	1264-8
21-1430	46-608	10-793	29-084	4-711	2-019	4321-4	3056-8	1264-6
21-1530	46-728	10-825	29-168	4-724	2-016	4328-7	3062-7	1266-0
21-1630	46-848	10-856	29-254	4-737	2-000	4336-8	3068-6	1268-2
21-1730	46-968	10-887	29-343	4-750	1-988	4344-9	3074-5	1270-4
21-1830	47-088	10-918	29-428	4-766	1-979	4352-2	3080-5	1271-7
21-1930	47-208	10-949	29-501	4-786	1-973	4361-3	3091-0	1276-4
21-2030	47-324	10-978	29-559	4-789	1-937	4370-8	3092-8	1277-9
21-2130	47-437	11-008	29-653	4-801	1-981	4377-5	3099-0	1278-5
21-2230	47-553	11-027	29-747	4-813	1-966	4384-5	3105-2	1279-3
21-2330	47-672	11-055	29-869	4-831	1-917	4392-6	3114-4	1278-9
22-0030	47-793	11-082	29-975	4-841	1-895	4403-6	3120-3	1283-3
22-0130	47-913	11-109	30-081	4-851	1-871	4414-7	3126-0	1285-7
22-0230	48-036	11-138	30-179	4-862	1-857	4424-4	3131-6	1290-7
22-0330	48-161	11-167	30-272	4-878	1-851	4433-5	3137-3	1296-9
22-0430	48-285	11-194	30-357	4-882	1-852	4441-1	3143-0	1299-1
22-0530	48-408	11-223	30-433	4-897	1-857	4448-3	3150-6	1297-8
22-0630	48-535	11-252	30-534	4-907	1-842	4457-2	3156-3	1301-0
22-0730	48-660	11-282	30-622	4-919	1-838	4465-6	3167-1	1303-5
22-0830	48-784	11-312	30-719	4-921	1-833	4470-1	3163-6	1308-5

APPENDIX V: TABLE VI.
RUN 8: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 8 OF 8

DAY.HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
22.0930	48.908	11.345	30.809	4.920	1.831	4476.6	3165.0	1311.6
22.1030	49.043	11.380	30.903	4.926	1.834	4484.7	3166.5	1318.2
22.1130	49.157	11.414	30.974	4.935	1.833	4495.0	3171.3	1323.7
22.1230	49.282	11.445	31.050	4.940	1.847	4504.7	3173.5	1331.1
22.1330	49.406	11.475	31.136	4.948	1.846	4513.8	3183.1	1330.7

APPENDIX F: TABLE VII PAGE 1 OF 10

SOLIDS REMOVED DURING RUN 6, KG. (RAW DATA)

DAY.HOUR	GASIF	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
1.0700	-	-	-	-	-	5.44	-
1.1145	-	-	-	6.12	0.	3.63	9.30
1.1445	-	-	-	14.63	0.	2.72	-
1.1630	-	-	-	-	-	-	2.49
0.1100	-	-	0.05	0.	3.63	-	0.55
1.2300	-	-	-	-	-	-	14.80
2.0300	4.76	-	-	5.44	9.45	8.16	-
2.0130	-	3.63	-	-	-	-	-
2.0500	-	-	-	2.27	0.45	6.12	-
2.0745	2.04	14.97	-	45.36	0.68	5.67	-
2.0815	1.13	-	-	-	-	-	-
2.1045	-	-	-	0.91	-	4.99	-
2.1145	-	-	-	-	-	-	3.03
2.1400	-	-	-	-	-	-	4.99
2.1445	-	-	-	0.91	1.59	7.26	-
2.1450	-	-	-	-	-	-	7.26
2.1800	-	2.95	-	0.91	10.89	7.26	-
2.2025	-	-	-	-	-	-	8.16
2.2040	-	-	-	0.91	10.89	5.44	-
2.2300	-	-	0.68	1.36	30.84	9.53	-
3.0030	2.72	-	-	-	-	-	-
3.0045	-	2.72	-	-	-	-	-
3.0050	-	-	-	-	-	-	5.44
3.0420	-	-	-	1.59	41.73	10.89	-
3.0700	3.63	2.72	-	-	-	-	1.81
3.0800	-	-	-	1.59	32.66	11.79	-
3.1200	-	-	-	1.36	19.96	7.26	-
3.1400	-	-	-	-	-	-	10.43
3.1545	-	-	-	-	6.35	4.08	-
3.2140	-	-	-	0.23	31.75	10.89	-
3.2300	-	-	-	-	-	-	2.49
4.0005	1.81	4.08	-	0.68	30.74	8.62	-
4.0120	-	-	-	-	-	-	11.79
4.0415	-	-	-	0.23	16.33	4.54	18.60
4.0645	-	-	0.23	-	-	-	-
4.0750	-	-	-	1.13	14.06	6.35	-
4.0850	2.27	2.72	-	-	-	-	-
4.1035	-	-	-	-	-	-	34.02
4.1200	-	-	-	0.45	14.51	4.76	-
4.1400	-	-	-	0.45	-	-	-

APPENDIX F: TABLE VII PAGE 9 OF 10

SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
4.1500	-	-	-	0.68	-	2.61	-
4.1600	-	-	-	0.34	5.44	-	-
4.1700	-	-	-	0.68	-	-	-
4.1800	-	-	-	0.57	-	-	-
4.1900	-	-	-	0.79	-	-	-
4.2000	1.59	1.59	1.70	9.07	3.63	-	1.91
4.2200	-	-	-	2.89	-	-	-
4.2300	-	-	-	2.45	-	-	-
5.0000	-	-	-	2.38	7.26	3.06	2.49
5.0100	2.27	2.27	-	2.04	-	-	-
5.0200	-	-	-	2.49	-	-	-
5.0300	-	-	-	1.70	-	-	-
5.0400	-	-	-	2.10	4.08	3.18	-
5.0500	-	-	-	2.27	-	-	-
5.0600	-	-	-	0.91	-	-	-
5.0700	-	-	-	1.81	-	-	-
5.0800	-	-	-	3.40	2.95	1.36	-
5.0800	-	-	-	-	2.95	1.36	-
5.0900	-	-	-	1.81	-	-	-
5.1100	-	-	-	9.30	2.72	1.81	-
5.1200	-	-	-	4.20	-	-	-
5.1300	-	-	-	0.12	-	-	-
5.1400	-	-	-	3.40	-	-	-
5.1500	1.36	1.36	-	0.91	2.72	2.95	-
5.1600	-	-	-	0.45	-	-	-
5.1700	-	-	-	0.11	-	-	-
5.1800	-	-	-	0.11	-	-	-
5.1900	-	-	-	0.23	1.59	1.81	-
5.1930	-	-	0.57	-	-	-	-
5.2100	-	-	-	0.54	-	-	-
5.2200	-	-	-	0.34	-	-	-
5.2300	-	-	-	0.34	-	-	-
6.0005	-	-	-	0.34	2.72	3.40	-
6.0100	-	-	-	0.34	-	-	-
6.0200	2.72	1.81	-	0.45	0.91	1.70	3.63
6.0400	-	-	-	0.79	2.27	-	-
6.0600	1.81	-	-	1.13	-	-	17.01
6.0800	-	1.81	-	0.68	-	-	-
6.1015	-	-	-	-	-	-	4.76
6.1115	-	-	-	-	-	-	4.54

APPENDIX F: TABLE VII PAGE 3 OF 10

SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER PACK	BOILER FLUE	ELUTR COARSE
6.1200	1.36	1.36	-	-	-	6.35	-
6.1215	-	-	-	-	-	-	4.76
6.1230	-	-	-	-	-	-	4.54
6.1315	-	-	-	-	-	-	4.76
6.1415	-	-	-	-	-	-	4.76
6.1515	-	-	-	-	-	-	5.44
6.1615	-	-	-	-	-	-	4.76
6.1715	-	-	-	-	-	-	5.22
6.1800	1.36	1.36	0.	1.36	4.08	4.99	-
6.1815	-	-	-	-	-	0.	-
6.1915	-	-	-	-	-	-	6.12
6.2015	-	-	-	-	-	-	6.12
6.2115	-	-	-	-	-	-	4.54
6.2215	-	-	-	-	-	-	4.54
6.2315	-	-	-	-	-	-	4.54
7.0000	1.81	1.81	-	1.13	3.86	4.54	-
7.0015	-	-	-	-	-	-	4.54
7.0115	-	-	-	-	-	-	4.54
7.0215	-	-	-	-	-	-	4.54
7.0315	-	-	-	-	-	-	4.54
7.0415	-	-	-	-	-	-	4.54
7.0515	-	-	-	-	-	-	4.54
7.0615	1.81	4.31	-	1.59	4.08	5.22	4.54
7.0715	-	-	-	-	-	-	4.54
7.0815	-	-	-	-	-	-	4.54
7.0915	-	-	-	1.59	5.44	5.90	4.54
7.1015	-	-	-	-	-	-	4.54
7.1115	-	-	-	-	-	-	4.54
7.1215	2.49	2.04	-	-	-	-	4.54
7.1315	-	-	-	-	-	-	4.54
7.1400	-	-	-	0.91	7.71	1.81	-
7.1415	-	-	-	-	-	-	4.54
7.1515	-	-	-	-	-	-	4.54
7.1615	-	-	-	-	-	-	4.54
7.1715	-	-	-	-	-	-	4.54
7.1815	1.59	3.18	-	-	-	-	4.54
7.1900	-	-	-	1.13	5.44	2.27	-
7.1915	-	-	-	-	-	-	4.54
7.2015	-	-	-	-	-	-	4.54
7.2145	-	-	-	1.13	-	-	-

SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GAS/S	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
7.2115	-	-	-	-	-	-	4.54
7.2215	-	-	-	-	-	-	4.54
7.2315	-	-	-	-	-	-	4.54
7.2350	2.72	2.72	-	-	2.04	1.59	-
8.0030	-	-	-	-	-	-	4.54
8.0130	-	-	-	-	-	-	4.54
8.0230	-	-	-	-	-	-	4.54
8.0330	-	-	-	-	-	-	4.54
8.0430	-	-	-	0.	-	-	4.54
8.0510	-	-	-	-	-	-	11.79
8.0530	-	-	-	-	-	-	4.54
8.0600	3.63	2.99	-	0.23	4.54	5.22	-
8.0630	-	-	-	-	-	-	4.54
8.0730	-	-	-	-	-	-	4.54
8.0830	-	-	-	-	-	-	4.54
8.0930	-	-	-	-	-	-	4.54
8.1030	-	-	-	-	-	-	4.54
8.1115	-	-	-	1.59	5.07	1.59	-
8.1130	-	-	-	-	-	-	4.54
8.1230	-	-	-	-	-	-	4.54
8.1330	2.27	4.54	-	-	-	-	4.54
8.1640	-	-	-	2.49	2.27	1.59	1.36
8.1800	1.81	4.54	-	-	-	-	-
8.1842	0.91	-	-	-	-	-	-
8.1845	0.67	-	-	-	-	-	-
8.1847	9.44	-	-	-	-	-	-
8.1850	7.71	-	-	-	-	-	-
8.1910	6.80	-	-	-	-	-	-
8.1915	5.90	-	-	-	-	-	-
8.1918	5.90	-	-	-	-	-	-
8.1920	9.07	-	-	0.23	1.36	1.13	-
8.1955	5.90	-	-	-	-	-	-
8.2000	7.71	-	-	-	-	-	-
8.2020	-	-	-	-	-	-	4.54
8.2140	-	-	-	-	-	-	4.54
8.2230	-	-	-	-	-	-	4.54
8.2330	-	-	-	-	-	-	4.54
9.0005	0.	3.13	-	1.36	2.27	2.04	-
9.0030	-	-	-	-	-	-	3.63
9.0130	-	-	-	-	-	-	4.54

SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GAS'R	BROWN	RECON CYCLONE	SLUTH FINES	BOILER BACK	BOILER FLUE	SLUTH COARSE
9.0230	-	-	-	-	-	-	4.54
9.0330	-	-	-	-	-	-	4.54
9.0430	-	-	-	-	-	-	4.54
9.0530	-	-	-	-	-	-	4.54
9.0600	4.08	3.63	-	1.13	2.27	2.72	-
9.0630	-	-	-	-	-	-	3.63
9.0730	-	-	-	-	-	-	4.54
9.0830	-	-	-	-	-	-	4.54
9.0930	-	-	-	-	-	-	4.54
9.1030	-	-	-	-	-	-	4.54
9.1130	-	-	-	0.68	3.63	1.36	4.54
9.1135	6.35	-	-	-	-	-	-
9.1147	6.35	-	-	-	-	-	-
9.1150	6.35	-	-	-	-	-	-
9.1154	6.80	-	-	-	-	-	-
9.1230	-	-	-	-	-	-	4.54
9.1305	7.71	-	-	-	-	-	-
9.1309	6.35	-	-	-	-	-	-
9.1312	7.71	-	-	-	-	-	-
9.1315	6.35	-	-	-	-	-	-
9.1330	-	1.81	-	-	-	-	4.54
9.1430	-	-	-	-	-	-	4.54
9.1515	-	2.49	-	-	-	-	-
9.1517	0.62	-	-	-	-	-	-
9.1520	0.62	-	-	-	-	-	-
9.1523	0.62	-	-	-	-	-	-
9.1526	0.68	-	-	-	-	-	-
9.1530	-	-	-	-	-	-	4.54
9.1630	-	-	-	-	-	-	4.54
9.1730	2.27	2.27	-	-	-	-	4.54
9.1800	-	-	-	0.23	1.13	1.13	-
9.1830	-	-	-	-	-	-	4.54
9.1930	-	-	-	-	-	-	4.54
9.2030	2.04	2.95	-	-	-	-	4.54
9.2130	-	-	-	-	-	-	4.54
9.2230	-	-	-	-	-	-	4.54
9.2315	-	-	-	-	-	-	1.36
10.2350	1.36	1.36	-	1.36	0.23	0.62	-
11.0300	6.35	-	-	0.68	-	0.12	-
11.0600	1.36	-	-	1.36	0.23	0.00	-

APPENDIX F: TABLE VII PAGE 6 OF 10

SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
11.0045	-	1.36	-	-	-	-	4.31
12.0430	-	9.30	-	-	-	-	-
12.0525	-	4.54	-	-	-	-	-
12.0800	1.36	1.36	-	1.36	-	6.80	-
12.1200	1.81	1.81	-	0.73	1.59	1.81	1.13
12.1500	-	-	-	-	-	-	4.54
12.1600	-	-	-	-	-	-	4.54
12.1700	-	-	-	-	-	-	9.07
12.1800	-	-	-	0.91	1.13	5.44	-
12.1845	-	-	-	-	-	-	9.07
12.1900	-	-	-	-	-	-	9.07
12.2000	-	-	-	-	-	-	9.07
12.2100	-	-	-	-	-	-	9.07
12.2200	-	-	-	-	-	-	9.07
12.2300	-	-	-	-	-	-	9.07
13.0000	1.36	1.36	-	1.36	1.36	3.63	9.07
13.0100	-	-	-	-	-	-	9.07
13.0200	-	-	-	-	-	-	9.07
13.0400	-	-	-	-	-	-	4.54
13.0500	-	-	-	-	-	-	9.07
13.0600	1.81	1.81	-	1.13	1.13	2.72	9.07
13.0700	-	-	-	-	-	-	9.07
13.0800	-	-	-	-	-	-	9.07
13.0900	-	-	-	-	-	-	9.07
13.1000	-	-	-	-	-	-	9.07
13.1100	-	-	-	-	-	-	9.07
13.1200	-	-	-	-	-	-	9.07
13.1300	-	-	-	0.91	0.91	5.44	9.07
13.1400	2.49	6.35	-	-	-	-	9.07
13.1500	-	-	-	-	-	-	9.07
13.1600	-	-	-	-	-	-	9.07
13.1700	-	-	-	-	-	-	9.07
13.1800	2.49	0.91	-	0.91	0.91	6.80	9.07
13.1900	-	-	-	-	-	-	9.07
13.2000	-	-	-	-	-	-	9.07
13.2100	-	-	-	-	-	-	9.07
13.2200	-	-	-	-	-	-	9.07
13.2300	2.04	2.04	-	0.68	1.81	3.18	9.98
13.2359	-	-	-	-	-	-	9.07
14.0100	-	-	-	-	-	-	9.07

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APPENDIX F, TABLE VII PAGE 7 OF 10

SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GAS/H	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR CHARGE
14.0200	-	-	-	-	-	-	0.07
14.0255	-	-	-	0.01	1.01	3.06	-
14.0300	-	-	-	-	-	-	0.07
14.0400	-	-	-	-	-	-	0.07
14.0500	-	-	-	-	-	-	0.07
14.0600	2.72	2.40	-	-	-	-	0.07
14.0615	-	-	-	0.45	0.45	3.63	-
14.0700	-	-	-	-	-	-	0.07
14.0800	-	-	-	-	-	-	0.07
14.0900	-	-	-	-	-	-	0.07
14.1000	-	-	-	-	-	-	0.07
14.1100	-	-	-	-	-	-	0.07
14.1200	0.01	0.01	-	0.01	0.45	0.35	0.07
14.1300	-	-	-	-	-	-	0.07
14.1400	-	-	-	-	-	-	0.07
14.1500	-	-	-	-	-	-	0.07
14.1600	-	-	-	-	-	-	0.07
14.1700	-	-	-	-	-	-	0.07
14.1800	0.01	0.01	1.36	1.36	0.01	4.08	0.
14.1900	-	-	-	-	-	-	13.01
14.2000	-	-	-	-	-	-	13.01
14.2100	-	-	-	-	-	-	13.01
14.2200	-	-	-	-	-	-	0.07
14.2300	-	-	-	-	-	-	0.07
15.0000	6.35	6.35	-	1.13	3.18	6.08	0.07
15.0100	-	-	-	-	-	-	0.07
15.0200	-	-	-	-	-	-	0.07
15.0300	-	-	-	-	-	-	0.07
15.0400	-	-	-	-	-	-	0.07
15.0500	-	-	-	-	-	-	0.07
15.0600	2.27	2.27	-	1.36	4.08	0.02	0.07
15.0700	-	-	-	-	-	-	0.07
15.0800	-	-	-	-	-	-	0.07
15.1000	-	-	-	-	-	-	0.07
15.1200	2.27	2.27	-	1.36	6.08	0.16	0.01
15.1800	2.27	2.27	-	1.36	0.07	14.51	-
15.1900	-	-	-	-	-	-	0.07
15.2000	-	-	-	-	-	-	0.07
15.2100	-	-	-	-	-	-	0.07
15.2300	-	-	-	-	-	-	0.07

APPENDIX C, TABLE VII
SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
15.2359	2.27	2.27	-	2.27	7.71	6.80	9.07
16.0100	-	-	-	-	-	-	9.07
16.0145	-	-	-	-	-	-	10.00
16.0300	-	-	-	-	-	-	9.07
16.0500	-	-	-	-	-	-	9.07
16.0600	-	-	-	-	-	-	9.07
16.0650	-	-	-	3.63	12.47	12.25	-
16.0700	1.81	1.81	-	-	-	-	9.07
16.0745	-	-	-	0.91	-	-	0.91
16.0800	-	-	-	-	-	-	9.07
16.0900	-	-	-	-	-	-	9.07
16.1000	-	-	-	-	-	-	9.07
16.1100	-	-	-	-	-	-	9.07
16.1200	1.81	1.36	-	1.13	6.80	4.99	9.07
16.1300	-	-	-	-	-	-	9.07
16.1400	-	-	-	-	-	-	9.07
16.1500	-	-	-	-	-	-	9.07
16.1600	-	1.36	-	-	-	-	9.07
16.1700	-	-	-	-	-	-	7.71
16.1800	1.81	1.81	-	1.81	4.08	3.18	0.91
16.1900	-	-	-	-	-	-	9.07
16.2000	-	-	-	-	-	-	9.07
16.2030	2.72	-	-	-	-	-	-
16.2100	-	-	-	-	-	-	9.07
16.2200	-	-	-	-	-	-	9.07
16.2215	-	-	-	-	-	-	6.80
16.2359	1.81	1.81	-	1.36	1.36	5.22	0.91
17.0300	-	-	-	-	-	-	9.07
17.0400	-	-	-	-	-	-	9.07
17.0500	-	-	-	-	-	-	9.07
17.0600	1.81	1.81	-	1.27	-	5.90	9.07
17.0700	-	-	-	-	-	-	9.07
17.0800	-	-	-	-	-	-	9.07
17.0830	16.56	13.38	-	-	-	-	-
17.0900	-	-	-	-	-	-	9.07
17.1000	-	-	-	-	-	-	9.07
17.1100	-	-	-	-	-	-	5.44
17.1200	1.81	1.81	-	0.91	9.07	5.44	4.54
17.1300	-	-	-	-	-	-	6.80
17.1500	-	-	-	-	-	-	6.80

SOLIDS REMOVED DURING RUN 6, KG. (RAW DATA)

DAY.HHMM	GAS/H	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
17.1600	-	-	-	-	-	-	6.80
17.1700	-	-	-	-	-	-	6.80
17.1800	-	-	-	0.91	7.71	6.35	6.80
17.1900	-	0.45	-	-	3.63	-	-
17.2000	-	-	-	-	-	-	4.54
17.2100	-	-	-	-	-	-	6.80
17.2359	1.81	0.	-	1.81	2.04	4.99	-
18.0630	1.81	0.	-	2.72	-	4.76	4.54
18.0700	-	-	-	-	-	-	4.54
18.0800	-	-	-	-	-	-	4.54
18.0900	-	-	-	-	-	-	4.54
18.1000	-	-	-	-	-	-	9.07
18.1200	1.81	1.81	-	1.81	4.99	4.54	9.07
18.1300	-	-	-	-	-	-	9.07
18.1400	-	-	-	-	-	-	6.80
18.1500	-	-	-	-	-	-	9.07
18.1600	-	-	-	-	-	-	9.07
18.1700	-	-	-	-	-	-	9.07
18.1730	45.36	-	-	-	-	-	-
18.1800	-	-	-	3.18	3.63	3.63	9.07
18.1900	1.81	2.72	-	-	-	-	-
18.1910	1.81	-	-	-	-	-	8.25
18.2000	-	-	-	-	-	-	9.07
18.2100	-	-	-	-	-	-	9.07
18.2200	-	-	-	-	-	-	9.07
18.2300	-	-	-	-	-	-	9.07
18.2359	1.81	1.81	-	1.13	6.35	2.72	9.07
19.0100	-	-	-	-	-	-	9.07
19.0800	13.15	1.81	-	4.99	9.53	7.94	8.91
19.0945	-	-	-	21.77	4.08	9.53	-
19.1200	4.54	2.72	-	7.26	3.18	4.08	9.91
19.1700	-	-	-	7.26	3.18	3.63	-
19.1805	1.36	1.36	-	-	-	-	-
19.2200	-	-	-	25.85	-	-	-
20.0600	-	-	-	-	262.63	-	-
20.2010	-	-	-	-	-	-	17.24
20.2200	-	-	-	6.58	-	6.80	-
20.2359	0.91	-	-	-	-	-	-
21.0730	1.81	-	-	-	-	-	4.54
21.0830	-	-	-	-	-	-	4.54

APPENDIX F: TABLE VII PAGE 10 OF 10

SOLIDS REMOVED DURING RUN 8, KG. (RAW DATA)

DAY.HOUR	GASF'R	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
21.0930	-	-	-	-	-	-	4.54
21.1130	2.27	1.81	-	-	-	-	4.54
21.1145	-	-	-	0.68	0.68	15.42	0.91
21.1230	-	-	-	-	-	-	4.54
21.1330	-	-	-	-	-	-	4.54
21.1430	2.27	0.91	-	-	-	-	4.54
21.1530	-	-	-	-	-	-	4.54
21.1630	-	-	-	-	-	-	4.54
21.1730	-	-	-	-	-	-	4.54
21.1800	-	-	-	0.45	2.27	9.07	-
21.1830	-	-	-	-	-	-	4.54
21.1930	-	-	-	-	-	-	4.54
21.2025	2.27	2.27	-	-	-	-	0.91
21.2030	-	-	-	-	-	-	4.54
21.2130	-	-	-	-	-	-	4.54
21.2300	-	-	-	-	-	-	4.54
22.0001	1.59	1.59	-	0.23	1.13	11.34	-
22.0030	-	-	-	-	-	-	4.54
22.0130	-	-	-	-	-	-	4.54
22.0230	-	-	-	-	-	-	4.54
22.0330	-	-	-	-	-	-	4.54
22.0430	-	-	-	-	-	-	4.54
22.0530	-	-	-	-	-	-	4.54
22.0600	2.04	-	-	1.36	0.91	6.80	-
22.0630	-	-	-	-	-	-	4.54
22.0730	-	-	-	-	-	-	4.54
22.0830	-	-	-	-	-	-	4.54
22.1030	-	-	-	4.54	-	-	-
22.1200	1.81	-	-	4.54	-	-	-
22.1300	-	-	-	0.91	-	5.44	-
22.1830	2.27	2.27	-	9.07	-	-	-
22.1900	-	-	-	0.91	1.81	-	-
22.2000	-	-	0.68	0.91	0.23	0.45	0.45
23.0000	425.82	20.94	-	26.76	22.68	18.43	-

APPENDIX F: TABLE VIII PAGE 1 OF 2

ANALYSIS OF SOLIDS REMOVED DURING RUN 8

T O T A L   C A R B O N   WT%

DAY.HOUR	DASFR	RECFR	RECFR CYCLONE	FLUID FINES	BOILER BACK	BOILER FLUE	FLUID COARSE
1.1000	0.20	-	-	-	0.35	2.65	-
2.0000	0.41	0.	-	2.90	-	-	-
2.0800	0.00	0.	-	-	-	-	0.46
2.1000	0.	-	-	-	-	-	-
3.0100	0.02	0.41	0.	0.76	0.	2.81	0.32
3.0700	1.22	0.04	-	-	-	-	0.67
3.1000	0.02	0.	-	-	-	-	0.
4.0010	0.02	0.02	-	5.71	0.86	2.02	2.03
4.0310	-	-	-	-	-	-	0.74
4.0645	-	-	0.38	-	-	-	-
4.0900	0.	0.	-	-	-	-	-
4.2000	0.24	0.	-	-	-	-	-
4.2350	0.21	0.	-	3.07	0.60	7.90	5.00
5.0000	0.32	0.	-	-	-	-	-
5.1100	-	-	-	1.56	-	-	-
5.1500	0.26	0.	-	-	-	-	-
5.2100	0.18	0.	-	-	-	-	-
6.0200	0.00	0.	-	10.59	0.39	6.80	0.14
6.0600	0.	-	-	-	-	-	-
6.0800	-	0.	-	-	-	-	-
6.1200	-	-	-	3.63	0.43	2.00	-
6.1600	0.15	0.	-	6.20	1.21	0.	0.
6.2350	0.10	0.	-	5.05	0.	6.20	0.04
7.0000	0.21	0.10	-	-	-	-	0.07
7.1200	0.20	0.	-	-	-	-	-
7.1345	-	-	-	-	-	-	0.25
7.1415	-	-	-	12.64	0.26	0.29	-
7.1600	0.15	0.	-	-	-	-	0.90
7.2350	0.	0.	-	7.00	0.16	9.14	0.35
8.0000	0.45	0.	-	6.22	0.	6.37	0.
8.1200	0.	0.	-	-	-	-	2.37
8.1600	0.12	0.	-	-	-	-	1.00
9.0005	0.	0.	-	13.06	0.	10.64	0.43
9.0800	0.	0.	-	-	0.00	-	1.52
9.1130	-	-	-	-	0.07	-	-
9.1320	0.	0.	-	-	-	-	2.71
9.1745	0.02	0.	-	-	-	-	0.
10.0130	0.	-	-	-	-	-	-
10.1500	-	-	-	-	0.	-	-
10.2350	0.	0.	-	23.54	0.	3.61	-

APPENDIX F: TABLE XXII PAGE 2 OF 2

ANALYSIS OF SOLIDS REMOVED DURING RUN 8

TOTAL CARBON WT%

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
11.0800	0.20	0.02	-	10.32	0.21	3.54	-
12.0800	0.	0.	-	-	-	-	-
12.1200	0.	0.01	-	0.70	-	-	0.22
12.2359	0.11	0.	-	1.91	0.	1.43	0.27
13.0800	0.	0.	-	-	-	-	0.
13.1300	0.	0.	-	-	-	-	0.03
13.1600	0.	0.	-	-	-	-	0.
13.1900	0.	0.	-	-	-	-	0.19
14.0800	0.	0.	-	-	-	-	0.51
14.1200	0.13	0.	-	-	-	-	0.39
14.1600	0.03	0.	-	-	-	-	0.20
14.2359	0.	0.	-	10.88	0.04	2.17	0.88
15.0800	0.	0.	-	-	-	-	2.71
15.1200	0.14	0.	-	-	-	-	0.03
15.1600	0.07	0.	-	-	-	-	-
15.2359	0.04	0.	-	4.99	0.02	1.98	0.73
16.0700	1.84	0.04	-	-	-	-	2.47
16.1200	0.17	0.	-	-	-	-	0.41
16.1600	0.21	0.	-	-	-	-	1.32
17.0800	3.50	0.02	-	-	-	-	5.27
17.1200	1.21	0.44	-	-	-	-	-
17.1600	-	-	-	14.80	-	-	1.03
18.0001	0.	0.	-	12.32	0.79	5.91	2.52
18.0800	0.75	0.	-	-	-	1.03	2.40
18.1200	0.50	0.	-	-	-	-	0.80
18.1600	0.39	0.	-	-	-	-	0.
19.0001	0.07	0.	-	-	-	-	1.04
19.0800	0.19	0.	-	-	-	-	0.06
19.1200	0.41	-	-	-	-	-	2.12
19.1605	1.25	0.10	-	-	-	-	-
20.0030	-	-	-	-	0.	-	-
21.0030	0.	-	-	-	-	-	-
21.1100	0.50	0.	-	-	-	-	-
21.1200	-	-	-	17.87	-	3.18	1.77
21.1457	0.09	0.05	-	-	-	-	-
21.2025	0.00	0.02	-	-	-	-	0.05
22.0001	0.25	0.	-	16.96	0.07	2.98	1.50
22.0800	0.09	-	-	-	-	-	0.22
22.1200	0.00	-	-	-	-	-	2.54
22.1600	0.12	0.	-	15.61	0.50	9.76	0.97
22.2000	0.11	0.	0.	15.61	0.50	9.76	0.97

APPENDIX 5: TABLE 15 PAGE 1 OF 2

ANALYSIS OF SOLIDS REMOVED DURING RUN 8

SULPHATE SULPHUR WT.%

DAY.HOUR	GAS-N	UNDER	UNDER CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
11.0800	0.10	1.00	-	0.90	2.03	3.00	-
12.0800	0.09	2.14	-	1.19	2.77	5.40	-
12.1200	0.20	2.04	-	1.05	1.37	4.45	0.44
12.2359	0.14	0.50	-	0.95	2.21	2.70	0.26
13.0800	0.16	1.26	-	0.83	-	-	0.51
13.1200	0.15	1.50	-	-	-	-	0.41
13.1600	0.15	1.40	-	-	-	-	0.44
13.2120	0.13	1.50	-	-	-	-	0.45
14.0800	0.20	1.84	-	-	-	-	0.33
14.1200	0.16	0.92	-	-	-	-	0.44
14.1600	0.15	1.14	-	-	-	-	0.21
14.2359	0.14	1.31	-	0.77	1.33	3.51	0.33
15.0800	0.13	0.85	-	-	-	-	0.40
15.1200	0.13	1.15	-	-	-	-	0.16
15.1600	0.17	1.40	-	-	-	-	-
15.2359	0.14	1.33	-	0.71	1.86	2.50	0.28
16.0700	0.12	0.89	-	-	-	-	0.16
16.1200	0.11	1.30	-	-	-	-	0.20
16.1600	0.11	0.80	-	-	-	-	0.24
17.0000	0.11	0.11	-	-	-	-	0.13
17.0800	0.12	0.80	-	-	-	-	0.15
17.1200	0.09	0.18	-	-	-	-	-
17.1600	-	-	-	0.41	-	-	0.17
18.0000	0.11	0.35	-	0.37	1.67	2.03	0.50
18.0800	0.15	0.34	-	-	-	2.24	0.57
18.1200	0.10	0.99	-	-	-	-	0.20
18.1600	0.10	0.57	-	-	-	-	0.23
19.0000	0.14	0.72	-	-	-	2.25	0.21
19.0800	0.10	0.32	-	-	-	-	0.20
19.1200	0.09	-	-	-	-	-	0.19
19.1600	0.07	0.07	-	-	-	-	-
20.0630	-	-	-	-	5.34	-	-
21.0630	2.05	-	-	-	-	-	-
21.1100	0.15	1.08	-	-	-	-	-
21.1200	-	-	-	3.00	-	4.96	1.14
21.1457	0.10	0.20	-	-	-	-	-
21.2025	0.09	0.18	-	-	-	-	0.72
22.0000	0.08	0.80	-	1.17	1.91	2.58	0.37
22.0800	0.08	-	-	-	-	-	0.31
22.1200	0.11	-	-	-	-	-	0.40

APPENDIX F: TABLE IX PAGE 2 OF 2

ANALYSIS OF SOLIDS REMOVED DURING RUN 8

SULPHATE SULPHUR WT.%

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER PACK	BOILER FLUE	ELUTR COARSE
1.1800	0.22	–	–	–	1.03	2.11	–
2.0800	0.17	1.17	–	0.65	–	–	–
2.0900	0.46	1.37	–	–	–	–	0.28
2.1800	0.14	–	–	–	–	–	–
3.0100	0.11	1.37	3.16	0.51	2.02	1.98	0.18
3.0700	0.13	1.42	–	–	–	–	0.25
3.1800	0.11	1.28	–	–	–	–	0.35
4.0010	0.14	1.00	–	1.86	1.05	1.62	0.34
4.0315	–	–	–	–	–	–	0.23
4.0045	–	–	4.44	–	–	–	–
4.0800	0.10	1.30	–	–	–	–	–
4.2000	0.10	1.08	–	–	–	–	–
4.2350	0.13	1.36	–	0.47	1.11	1.62	0.30
5.0800	0.14	0.98	–	–	–	–	–
5.1100	–	–	–	0.42	–	–	–
5.1500	0.12	1.01	–	–	–	–	–
5.2100	0.11	1.28	–	–	–	–	–
6.0200	0.17	1.30	–	0.46	2.10	2.27	0.26
6.0800	0.10	–	–	–	–	–	–
6.0800	–	1.43	–	–	–	–	–
6.1200	–	–	–	0.39	2.02	2.52	–
6.1800	0.16	1.35	–	0.38	1.00	2.30	0.25
6.2350	0.14	1.06	–	0.41	1.91	2.44	0.21
7.0800	–	–	–	–	–	–	–
7.1200	0.12	1.25	–	–	–	–	–
7.1345	–	–	–	–	–	–	0.32
7.1415	–	–	–	0.49	0.07	2.22	–
7.1800	0.15	1.35	–	–	–	–	0.20
7.2350	0.20	1.20	–	0.53	2.20	2.34	0.20
8.0800	0.24	1.34	–	0.56	3.22	3.18	0.33
8.1300	0.23	1.20	–	–	–	–	0.42
8.1800	0.17	1.33	–	–	–	–	0.34
9.0000	0.23	1.17	–	0.56	2.33	3.46	0.58
9.0800	0.23	1.44	–	0.49	2.58	3.35	0.42
9.1130	–	–	–	1.59	2.33	3.45	–
9.1320	0.24	1.26	–	–	–	–	0.54
9.1745	0.28	1.24	–	–	–	–	0.46
10.0030	2.08	–	–	–	–	–	–
10.1500	–	–	–	–	3.13	–	–
10.2350	0.31	2.36	–	1.13	3.20	4.78	–
22.1800	0.12	1.23	–	0.82	1.54	2.54	0.18
22.2000	0.12	1.23	4.44	0.82	1.54	2.54	0.18

APPENDIX F: TABLE X PAGE 1 OF 2

ANALYSIS OF SOLIDS REMOVED DURING RUN 8

TOTAL SULPHUR WT.%

DAY.HOUR	GAS'R	REGEN	REGEN CYCLONE	SUPER FINES	BOILER BACK	BOILER FLUE	SUPER COARSE
2.0000	4.31	-	-	-	4.03	2.79	-
2.0800	4.37	2.97	-	4.65	-	-	-
2.1800	3.80	2.53	-	-	-	-	3.75
3.0100	3.74	-	-	-	-	-	-
3.0700	3.75	2.80	6.97	4.78	2.64	2.39	3.78
3.1500	4.30	3.18	-	-	-	-	3.91
4.0010	3.37	2.88	-	-	-	-	3.85
4.0310	3.17	2.89	-	4.85	3.07	2.82	3.10
4.0640	-	-	-	-	-	-	3.88
4.0900	-	-	6.30	-	-	-	-
4.2000	3.05	2.11	-	-	-	-	-
4.2350	3.78	2.70	-	-	-	-	-
5.0600	3.95	2.07	-	3.89	3.18	2.95	3.79
5.1100	4.40	2.95	-	-	-	-	-
5.1500	-	-	-	4.49	-	-	-
5.2100	4.46	3.33	-	-	-	-	-
6.0000	4.14	3.15	-	-	-	-	-
6.0600	4.81	3.97	-	6.17	3.71	3.40	3.80
6.0800	4.89	-	-	-	-	-	-
6.1000	-	3.30	-	-	-	-	-
6.1800	4.89	3.35	-	5.20	3.08	3.02	5.19
6.2350	4.93	3.50	4.95	3.58	3.60	5.10	6.93
7.0600	-	-	-	-	-	-	-
7.1000	5.20	3.50	-	-	-	-	4.36
7.1345	-	-	-	-	-	-	-
7.1415	-	-	-	5.89	4.21	3.45	6.11
7.1800	4.41	3.43	-	-	-	-	5.33
7.2350	4.38	3.85	-	6.79	3.47	3.85	5.80
8.0640	4.58	3.40	-	4.04	3.94	5.60	3.09
8.1300	5.10	2.88	-	-	-	-	5.74
8.1800	4.76	3.54	-	-	-	-	5.49
9.0000	4.40	3.60	-	6.15	4.07	4.74	5.39
9.0600	4.96	3.87	-	-	4.47	-	-
9.1130	-	-	-	-	4.57	-	-
9.1500	4.87	3.61	-	-	-	-	5.17
9.1745	4.81	3.40	-	-	-	-	6.09
10.0030	4.93	-	-	-	-	-	-
10.1500	-	-	-	-	3.65	-	-
10.2350	4.92	3.65	-	5.38	4.11	5.40	-
11.0000	4.58	4.20	-	3.95	5.04	4.10	-

APPENDIX F: TABLE [illegible] PAGE 2 OF 2

ANALYSIS OF SOLIDS REMOVED DURING RUN 8

TOTAL SULFUR WT.%

DAY.HOUR	GAS'R	[illegible]	[illegible] CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
12.0800	3.66	8.70	-	-	-	-	-
12.1600	8.50	3.18	-	10.50	-	-	6.69
12.2300	4.80	8.94	-	8.01	4.18	3.87	4.89
13.0800	4.18	3.50	-	-	-	-	4.03
13.1200	3.26	3.05	-	-	-	-	5.10
13.1600	3.45	8.63	-	-	-	-	5.30
13.2300	3.57	8.71	-	-	-	-	5.58
14.0800	4.81	3.05	-	-	-	-	5.19
14.1200	4.96	3.33	-	-	-	-	5.11
14.1600	4.73	3.33	-	-	-	-	4.85
14.2300	4.35	3.70	-	4.97	4.85	3.98	4.90
15.0800	4.17	3.80	-	-	-	-	5.85
15.1200	4.96	3.41	-	-	-	-	4.54
15.1600	4.45	4.00	-	-	-	-	-
15.2300	5.52	4.13	-	5.74	4.41	3.44	5.56
16.0700	5.67	5.88	-	-	-	-	5.13
16.1200	7.56	5.53	-	-	-	-	5.79
16.1600	6.66	5.36	-	-	-	-	4.95
17.0000	7.14	6.76	-	-	-	-	4.97
17.0800	8.32	8.78	-	-	-	-	7.34
17.1200	10.88	8.44	-	-	-	-	-
17.1600	-	-	-	4.08	-	-	6.58
18.0000	8.10	7.66	-	3.90	5.01	4.55	5.65
18.0800	8.31	7.19	-	-	-	3.46	5.86
18.1200	8.65	7.83	-	-	-	-	4.97
18.1600	8.01	7.73	-	-	-	-	4.81
19.0000	7.50	6.31	-	-	-	3.85	4.54
19.0800	7.38	5.07	-	-	-	-	5.19
19.1200	7.05	-	-	-	-	-	5.08
19.1600	8.71	7.58	-	-	-	-	-
20.0830	-	-	-	-	5.48	-	-
21.0830	7.06	-	-	-	-	-	-
21.1100	7.40	4.65	-	-	-	-	-
21.1200	-	-	-	6.73	-	5.88	6.90
21.1457	7.15	6.13	-	-	-	-	-
21.2005	7.71	7.51	-	-	-	-	6.90
22.0000	7.73	6.50	-	4.89	4.76	3.88	5.81
22.0800	7.37	-	-	-	-	-	5.75
22.1200	6.58	-	-	-	-	-	6.71
22.1600	6.41	5.09	-	5.46	5.18	4.06	7.03

APPENDIX P: TABLE [illegible]

[illegible]

SAMPLE NUMBER	DRY- TIME	3350 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
				WT. PERCENT.						
58000	.0000	.1	1.2	1.7	5.6	14.2	48.6	16.3	4.5	7.8
58487	1.0400	1.3	6.6	12.[illegible]	27.3	33.1	19.2	.0	.0	.3
58484	1.1000	1.1	10.8	11.4	26.2	27.7	22.3	.1	.0	.0
58481	1.1003	.1	.4	.2	1.3	2.4	47.3	19.9	8.0	29.5
58506	2.0001	.9	10.4	11.5	22.6	28.0	25.3	.0	.1	.0
58511	2.0750	.8	8.7	9.8	28.4	40.4	19.8	.2	.0	.0
58516	2.1000	1.3	14.7	16.0	34.4	32.7	.7	.2	.0	.0
58526	3.0700	1.0	13.2	14.4	31.0	27.3	12.3	.0	.0	.0
58523	3.0040	.9	13.0	13.8	32.7	25.2	14.3	.1	.1	.0
58535	3.1000	1.0	12.5	14.6	35.3	24.7	11.4	.1	.0	.0
58532	4.0000	.8	14.2	14.9	30.2	29.3	7.8	.3	.1	.0
58552	4.0700	.7	13.0	14.3	28.4	28.1	15.3	.0	.0	.0
58561	4.2250	.5	13.3	14.2	27.9	27.1	16.6	.3	.1	.0
58554	4.3000	.6	12.7	14.2	27.9	27.7	16.4	.4	.1	.1
58563	5.0400	.6	11.2	13.5	26.8	27.8	19.4	.6	.2	.0
58560	5.0100	.6	10.8	12.8	27.2	28.3	19.8	.5	.1	.0
58562	5.2250	.6	11.0	12.5	26.9	28.8	18.9	.2	.1	.0
58564	5.0400	.4	10.4	12.9	26.1	28.7	21.3	.1	.0	.0
58567	5.1300	.5	11.8	14.1	32.6	27.0	13.0	.3	.0	.0
58572	6.0000	.6	10.4	13.2	26.5	28.4	20.2	.4	.0	.0

APPENDIX F: TABLE XI

RUN 8 — [illegible]

SIEVE SIZE IN MICRONS.

SAMPLE NUMBER	DAY-TIME	3000 2000	2000 1400	1400 1100	1100 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
58671	6-0500	.7	10.9	13.2	26.6	28.1	20.2	.3	.0	.0
58677	6-0600	.6	11.4	13.7	32.9	23.8	17.2	.2	.0	.0
58678	5-0600	.5	10.3	14.7	29.7	26.3	18.1	.4	.0	.0
58693	6-1000	1.3	13.0	15.6	37.9	9.6	22.5	.0	.0	.0
58695	6-1200	.8	9.6	11.8	33.7	26.4	17.7	.4	.0	.0
58696	6-2250	.6	.4	14.5	39.3	29.6	15.5	.1	.0	.0
58715	7-1000	.7	1.3	4.6	30.4	36.3	24.3	.3	.1	.0
58702	7-0600	.5	9.6	10.5	26.4	27.0	21.5	.6	.0	.0
58707	7-1000	.4	9.8	10.4	31.2	30.4	14.4	.1	.0	.0
58735	8-1000	.4	6.4	13.2	30.3	35.0	13.9	.6	.0	.0
58733	8-1300	.6	9.6	10.9	29.2	34.1	22.9	.7	.1	.0
58738	9-1300	.4	10.0	10.7	27.0	30.5	18.5	.0	.0	.0
58766	9-1745	.5	10.3	13.0	30.3	31.9	11.7	.0	.0	.0
58788	10-0300	.6	8.3	10.9	25.0	30.1	23.1	.6	.6	.6
58803	10-2250	.4	[illegible]	10.3	27.1	29.8	20.5	.2	.0	.0
58809	13-0600	.4	10.4	12.6	27.0	30.4	19.1	.1	.0	.0
58836	14-1000	.4	14.0	6.1	34.6	22.3	18.0	.0	.0	.0
58845	14-1000	.3	11.9	14.6	31.4	27.3	12.6	.0	.0	.0
58834	14-2400	.4	11.9	14.0	33.1	27.5	13.2	.0	.0	.0

APPENDIX F: TABLE XI

RUN 8 - [illegible] SED PARTICLE DISTRIBUTIONS (Cont)

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	[illegible] 2000	2000 1400	1400 1100	1100 850	850 600	600 250	250 150	150 100	100
					WT- PERCENT					
[illegible]	14-0259	.3	13.7	15.5	31.0	27.6	10.7	.1	.0	.0
[illegible]	15-1000	23.4	9.5	11.8	24.1	23.0	7.9	.0	.0	.0
[illegible]	15-1000	.3	10.0	15.4	31.0	29.5	13.0	.0	.0	.0
[illegible]	15-0800	.4	13.4	16.3	31.6	28.0	9.5	.0	.0	.0
[illegible]	[illegible]	.2	10.2	15.0	29.0	27.5	15.0	.2	.0	.0
[illegible]	15-1000	.3	11.7	14.9	30.5	27.9	14.4	.1	.1	.1
[illegible]	16-1000	.2	8.3	13.3	31.3	34.4	12.4	.1	.0	.0
[illegible]	16-1000	.2	11.1	14.0	30.5	30.5	14.6	.0	.1	.0
[illegible]	16-0700	.2	13.1	16.1	37.2	22.1	9.9	.1	.1	.1
[illegible]	17-1000	.2	9.6	13.6	29.4	29.0	17.0	.0	.1	.0
[illegible]	17-0001	.3	10.0	14.6	29.0	28.1	16.1	.3	.1	.0
[illegible]	[illegible]	.3	11.6	15.4	30.3	26.6	15.0	.1	.0	.0
[illegible]	18-0001	.1	8.0	13.7	29.5	31.7	16.6	.3	.0	.0
[illegible]	18-1200	.0	7.8	12.7	29.1	31.5	19.0	.0	.0	.0
[illegible]	18-1000	.4	15.7	16.1	28.2	25.1	13.7	.0	.0	.1
[illegible]	18-0100	.2	6.8	11.6	28.7	31.1	21.3	.3	.0	.0
[illegible]	19-2001	.2	22.0	10.7	24.5	25.9	16.7	.0	.0	.0
[illegible]	19-0600	.2	5.9	10.2	26.4	30.5	25.6	.6	.2	.2
[illegible]	19-1000	.0	9.3	13.4	29.6	30.7	17.0	.1	.0	.0
[illegible]	21-1450	.2	8.2	13.0	[illegible]	31.0	15.5	.0	.0	.0
[illegible]	21-1000	.2	8.6	13.4	30.5	30.5	16.7	.1	.1	.0
[illegible]	21-0005	.1	7.3	20.3	41.0	22.0	9.3	.0	.0	.0
[illegible]	21-0630	.3	8.9	13.3	29.6	30.0	18.9	.1	.0	.0
[illegible]	22-0400	.2	8.6	13.7	31.1	29.0	16.5	.1	.0	.1
[illegible]	22-0001	.2	7.9	13.3	34.5	22.3	20.9	.0	.0	.0
[illegible]	22-1000	.1	8.5	13.4	35.1	28.4	17.3	.1	.0	.0

[illegible]

[illegible]

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	3350 2800	2800 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
					WT. PERCENT.					
SB600	2-0130	.6	7.9	9.2	20.3	29.3	32.4	.0	.0	.0
SB609	2-0700	.4	7.4	9.1	23.7	28.2	30.2	1.1	.0	.0
SB636	3-1100	1.0	12.1	13.1	27.0	29.2	16.2	.5	.1	.0
SB622	3-0400	.5	9.8	10.0	25.1	29.0	22.9	1.0	.1	.0
SB625	3-0752	.6	9.6	11.8	29.0	28.7	19.8	1.3	.1	.0
SB631	4-0900	.5	10.0	11.7	25.7	28.0	21.4	.6	.2	.0
SB633	4-0100	.6	9.6	11.9	27.1	31.3	19.1	.5	.0	.0
SB648	4-2359	.7	10.1	12.0	24.8	26.9	23.1	2.2	.1	.0
SB670	5-2100	.4	7.7	10.6	24.4	29.7	26.4	.9	.0	.0
SB645	5-0400	.7	9.2	12.7	25.0	28.2	23.2	1.1	.0	.0
SB660	5-1500	.8	8.8	12.3	25.9	29.3	23.0	.6	.0	.0
SB679	6-0400	.4	6.9	9.9	22.1	28.5	30.0	2.2	.0	.0
SB694	6-1900	.3	8.1	10.7	24.5	29.4	26.3	.5	.2	.0
SB697	6-2359	.5	9.6	12.6	25.9	27.6	23.0	.7	.1	.0
SB673	6-0200	.5	9.4	11.6	24.6	27.7	24.1	1.6	.3	.0
SB703	7-0450	.6	9.7	10.9	25.8	29.1	22.0	.2	.0	.0
SB686	6-1300	.6	10.4	12.6	27.0	30.4	19.1	.1	.0	.0
SB708	7-1250	.2	8.0	11.0	26.5	31.1	22.9	.3	.0	.0
SB714	7-1800	.4	9.9	12.5	27.8	29.3	20.4	.4	.1	.0
SB723	7-2345	.6	9.0	12.1	26.5	29.7	21.9	.3	.3	.0

-2-

APPENDIX [illegible] TABLE [illegible]

[illegible] — [illegible] (Cont)

SAMPLE NUMBER	DAY-TIME	3350 2800	2800 1400	1400 1100	1100 850	850 600	600 250	250 150	150 100	100
		SIEVE SIZE IN MICRONS			WT. PERCENT					
58734	9-0600	.3	8.5	11.1	25.[illegible]	30.2	23.9	.3	.6	.0
58731	9-1300	.5	9.0	11.5	26.2	29.5	22.5	.0	.0	.0
58736	9-1800	.4	9.5	11.7	26.8	29.6	21.6	.4	.0	.0
58742	9-0005	.4	8.6	12.1	30.9	34.3	13.8	.0	.0	.0
58750	9-0600	.4	9.[illegible]	10.4	27.5	31.1	19.3	.1	.1	.0
58759	9-1330	.3	8.1	11.6	27.0	31.7	21.2	.4	.0	.0
58765	9-1745	.4	10.1	10.6	28.4	30.8	19.1	.1	.0	.0
58772	10-2359	.2	7.8	11.5	31.4	32.3	16.4	.4	.0	.0
58777	11-0600	.2	7.4	10.4	24.6	31.0	26.2	.0	.2	.0
58798	12-0600	.3	9.3	12.3	28.8	32.2	18.1	.0	.0	.0
58792	12-1200	.2	10.7	10.5	23.8	26.9	19.5	1.0	.3	.0
58803	12-2359	.3	8.5	11.2	25.6	30.7	21.6	.0	.0	.0
58819	13-1800	.2	10.1	11.7	27.2	30.6	19.9	.2	.1	.0
58818	13-0600	.2	3.2	11.9	37.8	32.3	15.4	.0	.0	.0
58812	13-1300	.3	10.7	13.4	35.1	27.5	12.3	.4	.1	.0
58831	13-2359	.3	11.3	13.3	27.6	28.7	18.1	.4	.2	.0
58835	14-0602	.3	10.8	13.9	32.5	30.4	11.5	.2	.0	.0
58837	14-1200	.4	12.9	15.3	36.9	26.6	9.6	.2	.1	.0

-3-

[illegible]

[illegible] (Cont)

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	3200 2800	2800 1400	1400 1100	1100 750	750 400	400 250	250 150	150 100	100
		WT. PERCENT								
S0846	14-1800	.2	11.3	14.4	29.5	28.9	15.2	.4	.1	.0
S0858	14-2359	.3	14.0	16.0	21.4	26.8	18.8	.1	.0	.1
S0862	15-0600	.3	14.1	16.4	33.6	21.7	13.6	.3	.0	.0
S0864	15-1200	.2	11.8	13.7	29.5	27.4	14.3	2.3	1.2	.1
S0872	15-1800	10.1	22.1	30.9	25.0	9.9	.1	.0	.0	.0
S0883	15-2359	.0	10.6	13.9	25.7	33.2	14.3	2.0	.2	.1
S0885	16-0700	.2	11.1	14.5	30.5	27.6	15.9	.1	.0	.0
S0895	16-1200	.4	9.2	13.2	27.8	28.1	20.2	1.0	.0	.0
S0901	16-1800	.2	10.5	14.4	29.9	28.8	16.0	.1	.0	.0
S0919	17-1200	.1	8.2	13.1	29.7	30.2	18.5	.1	.0	.1
S0903	17-0001	.2	11.0	14.2	31.3	29.6	13.1	.5	.0	.0
S0909	17-0600	.2	10.5	14.4	29.7	27.3	17.6	.3	.0	.0
S0925	18-0001	.2	10.2	14.2	27.6	28.3	18.1	1.2	.2	.2
S0931	18-0600	.2	6.0	9.8	25.3	30.1	27.3	1.2	.0	.0
S0942	18-1200	.0	7.9	10.1	26.9	29.6	23.3	1.3	.0	.0
S0970	19-1005	.2	9.6	11.7	27.4	27.9	22.6	.6	.0	.0
S0948	18-1800	.1	5.6	10.3	30.1	31.8	23.7	.3	.1	.0
S0950	19-0501	.0	5.9	12.8	29.9	32.8	19.4	.0	.0	.0
S0958	19-0600	.2	8.6	10.7	27.6	27.3	20.0	1.5	.2	.0
S0980	21-1457	.0	7.9	14.0	30.0	29.3	20.1	.6	.0	.0
S0984	21-0025	.1	9.2	13.2	29.4	29.7	19.2	.1	.0	.2
S0978	21-1200	.3	9.4	13.7	28.1	29.0	18.1	.1	.1	.6
S0988	22-0001	.2	8.7	13.1	29.6	29.9	18.3	.0	.0	.0
S1407	22-1800	.2	6.9	11.5	27.3	29.9	21.7	2.3	.4	.6

APPENDIX F: TABLE II

RUN 8 – [illegible]

		SIEVE SIZE IN MICRONS								
SAMPLE NUMBER	DAT-TIME	2380 2000	2000 1400	1400 1190	1190 840	840 600	600 250	250 150	150 100	-100
		WT. PERCENT.								
58621	3-0100	.3	3.1	4.1	11.6	18.7	49.9	7.2	1.9	3.0
5?463	3-1000	.3	3.3	4.5	10.0	20.6	46.7	5.1	.9	2.3
58638	3-0745	.4	6.8	8.2	19.1	18.6	37.5	3.0	1.1	5.4
58624	3-0700	.1	2.7	4.0	12.2	16.6	47.6	7.5	.9	8.3
58659	4-0005	.2	1.7	2.8	7.9	13.2	46.0	15.0	8.5	13.7
58659	4-2250	.2	4.6	6.0	13.2	18.7	50.0	1.9	1.7	.8
58674	6-0000	.1	2.1	3.5	10.1	16.9	49.0	12.4	.9	4.8
58680	6-1015	.2	1.2	2.0	4.8	18.4	50.9	19.6	5.3	5.6
58684	6-1215	.0	1.4	2.2	6.7	13.3	46.8	17.3	5.4	6.0
58693	6-1800	.0	1.6	2.4	7.0	14.6	45.4	17.6	6.4	9.1
68690	6-2250	.1	2.4	4.2	10.6	18.0	47.7	10.5	1.0	4.6
58704	7-0400	.1	2.9	4.4	11.0	15.4	45.3	9.0	2.0	5.1
58706	7-1345	.1	2.2	3.4	11.4	17.0	45.5	10.5	1.4	6.3
58713	7-1800	.0	1.6	3.1	9.5	18.6	38.9	23.2	.3	4.6
58717	7-2250	.1	1.4	2.4	6.9	12.8	51.9	13.4	3.4	7.7
58776	8-0100	.1	2.2	3.2	9.1	15.6	44.0	[illegible]	3.0	10.6
58790	8-1755	.1	1.0	3.4	11.1	22.9	37.6	19.3	.2	3.7
58732	8-1300	.1	2.1	4.2	11.5	21.6	42.9	7.0	.4	9.1
58732	8-1300	.1	2.1	4.2	11.5	21.6	42.9	7.0	.6	9.1
58740	9-0005	.0	1.5	2.0	9.1	21.1	51.1	12.6	.2	.6
58748	9-0400	.2	1.4	2.5	7.5	15.1	58.1	10.4	1.8	10.9

APPENDIX F: TABLE II

RUN 8 – [illegible] (Cont)

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	2380 2000	2000 1400	1400 1100	1100 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
58754	9-1745	.0	.3	.6	2.1	4.7	59.9	27.2	.1	5.1
58760	9-1325	.0	.7	1.6	5.9	13.7	52.0	20.8	.5	4.8
58768	9-0005	.3	1.5	2.8	9.1	21.1	51.1	13.6	.2	.6
58773	10-1200	.0	.5	2.8	6.3	18.1	27.8	17.4	5.6	19.4
58799	10-2359	.1	1.4	2.4	7.2	24.9	38.5	11.7	2.7	9.1
58805	13-0400	.1	2.9	4.4	12.8	25.6	41.3	6.6	.9	4.1
58816	13-1200	.1	2.7	4.2	10.8	17.4	44.3	15.1	.2	8.2
58822	13-1800	.0	3.2	4.1	11.8	18.3	44.7	7.6	2.7	8.5
58828	13-2300	.1	4.2	5.5	12.5	17.9	35.4	7.9	2.8	10.8
58832	14-0600	.0	2.3	3.5	11.2	22.8	44.8	9.5	1.8	5.6
58840	14-1200	.0	3.1	4.9	13.5	25.6	43.3	9.1	.2	.8
58832	14-0600	.0	2.3	3.5	11.2	22.8	44.8	9.5	1.8	5.6
58849	14-1800	.1	2.8	2.4	13.1	24.1	45.7	5.3	1.3	5.2
58855	14-2359	.0	1.7	3.1	11.3	21.4	39.4	8.9	3.2	11.0
58859	15-0600	.0	1.7	3.1	10.9	21.7	43.3	14.4	.6	4.4
58867	15-1200	.0	2.7	4.4	11.5	17.1	45.0	13.6	.5	5.2
58879	15-2359	.0	1.5	2.5	7.2	13.0	48.6	10.8	5.1	11.5
58887	16-0745	.1	3.7	5.5	13.0	17.2	40.1	10.3	2.0	8.1
58891	16-1200	.0	3.6	5.3	14.2	22.1	43.0	7.7	1.3	3.3

[illegible] TABLE II

[illegible] (Cont)

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	2800 2000	2000 1400	1400 1100	1100 850	850 400	400 250	250 150	150 100	100
		WT. PERCENT								
SEP17	16-1000	.0	2.0	3.5	9.5	17.0	48.5	9.7	2.4	6.4
SEP18	17-0600	.0	3.3	5.5	16.2	21.2	48.3	9.3	.4	1.0
SEP06	16-0630	.0	2.4	3.6	12.7	25.0	44.2	8.6	2.2	5.3
SEP04	17-0001	.0	1.8	3.1	7.4	18.1	25.4	27.4	2.0	13.8
SEP10	17-1000	.1	3.5	5.5	18.9	18.5	38.7	18.9	.6	3.3
SEP14	17-1200	.1	3.4	5.5	13.8	18.6	48.0	9.4	1.4	7.9
SEP26	18-0001	.0	2.1	3.9	18.7	16.2	32.7	21.8	.4	2.2
SEP32	18-0600	.0	2.3	3.2	9.7	13.0	35.2	30.5	.4	3.6
SEP37	18-1000	.0	2.5	4.5	11.5	16.8	41.9	12.4	3.8	7.3
SEP43	18-1200	.0	1.3	2.7	7.3	11.6	43.9	14.7	2.7	14.7
SEP50	19-0600	.0	1.7	3.1	8.6	14.0	46.2	15.9	2.0	7.4
SEP51	19-0001	.0	1.5	3.2	9.6	28.3	56.6	8.2	.1	.5
SEP63	19-1000	.1	5.0	3.6	11.7	18.1	40.6	17.0	.5	4.4
SEP82	21-0545	.1	4.0	7.1	27.2	38.2	29.8	1.7	.0	.8
SEP74	21-1000	.0	2.2	4.5	18.1	24.7	29.6	28.6	.2	.1
SL447	20-1200	.0	1.8	3.5	14.0	15.9	48.6	28.6	.8	6.8
SEP96	22-0600	.0	1.7	3.8	18.8	18.7	43.5	16.7	.5	4.2
SEP91	22-0001	.0	2.1	4.7	14.1	23.7	34.1	5.0	.2	6.1

SAFE RUN 8.

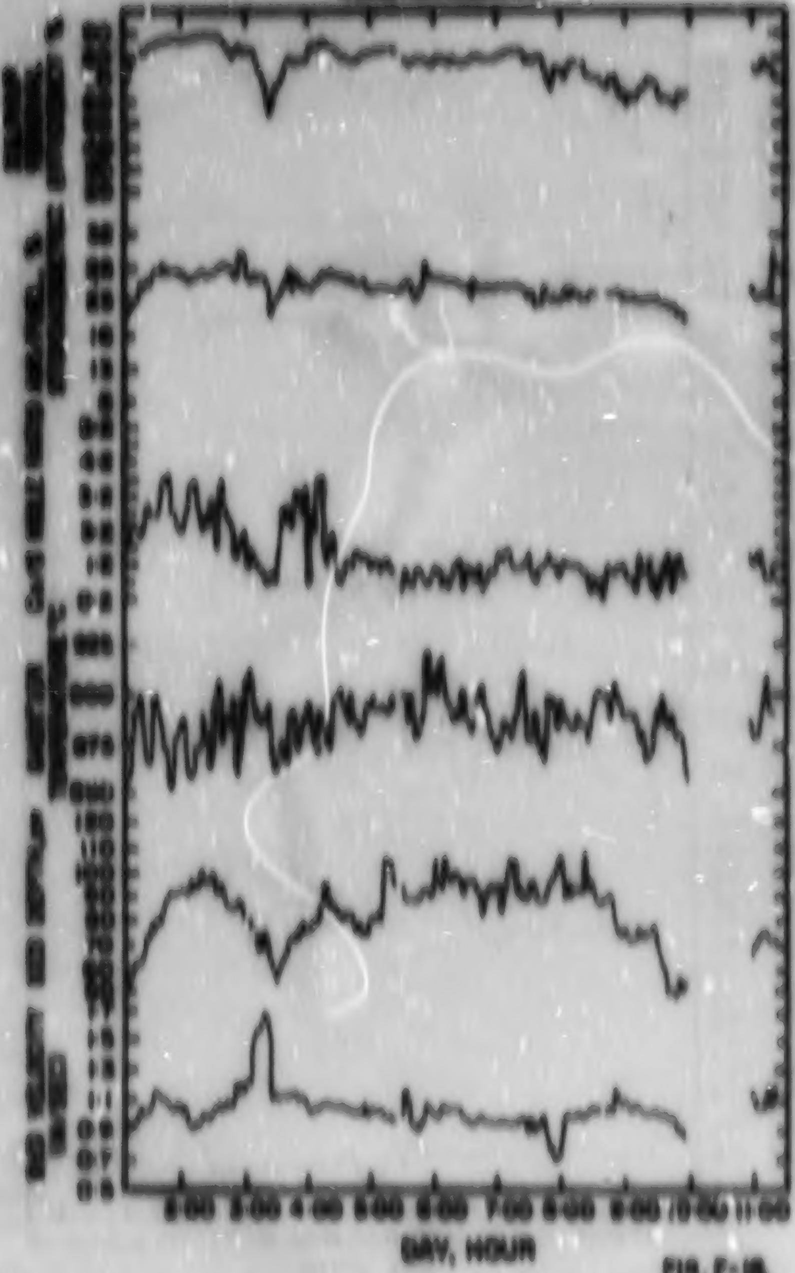

FIG. F-18.

CAFB RUN 8(cont'd)

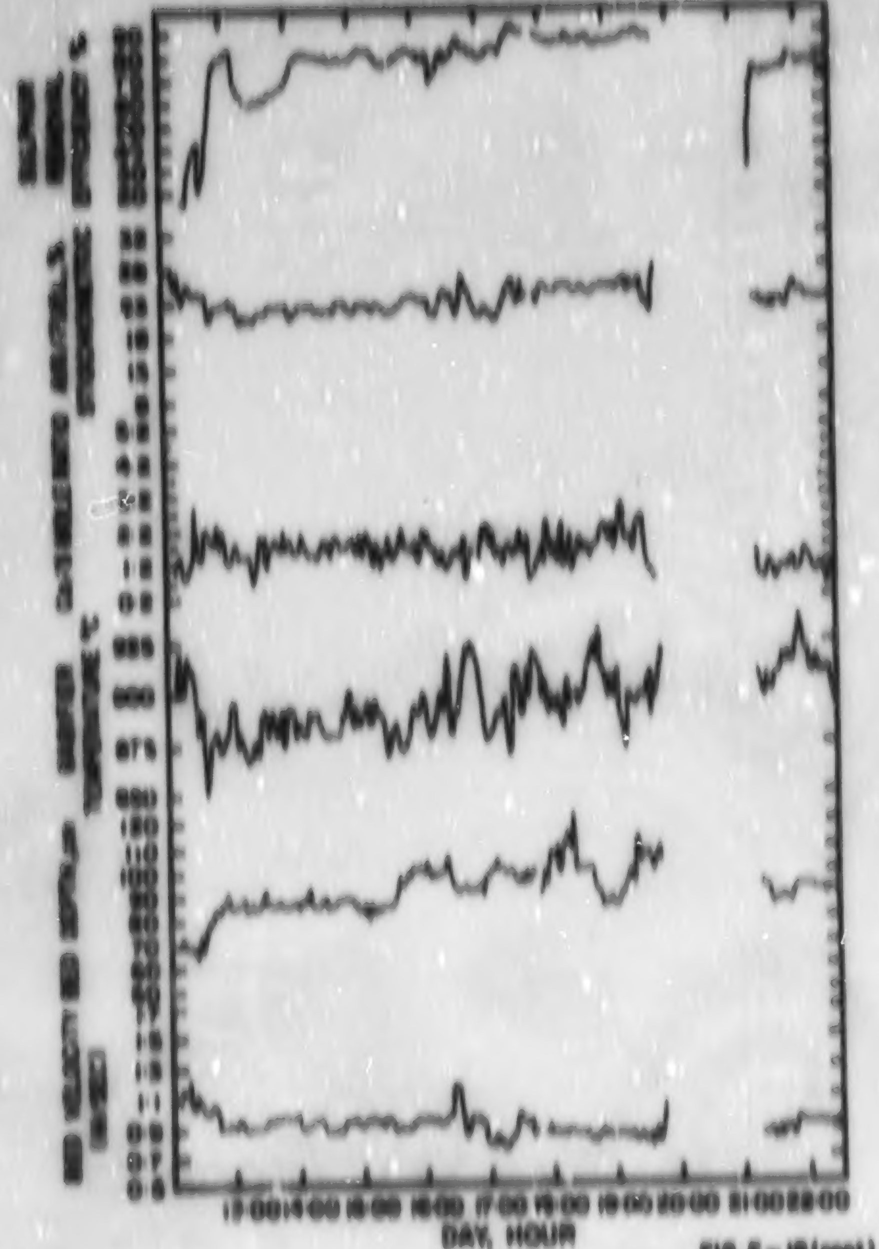

FIG. F-18(cont)

GASIFIER TOP SPACE PRESSURE RUN 8

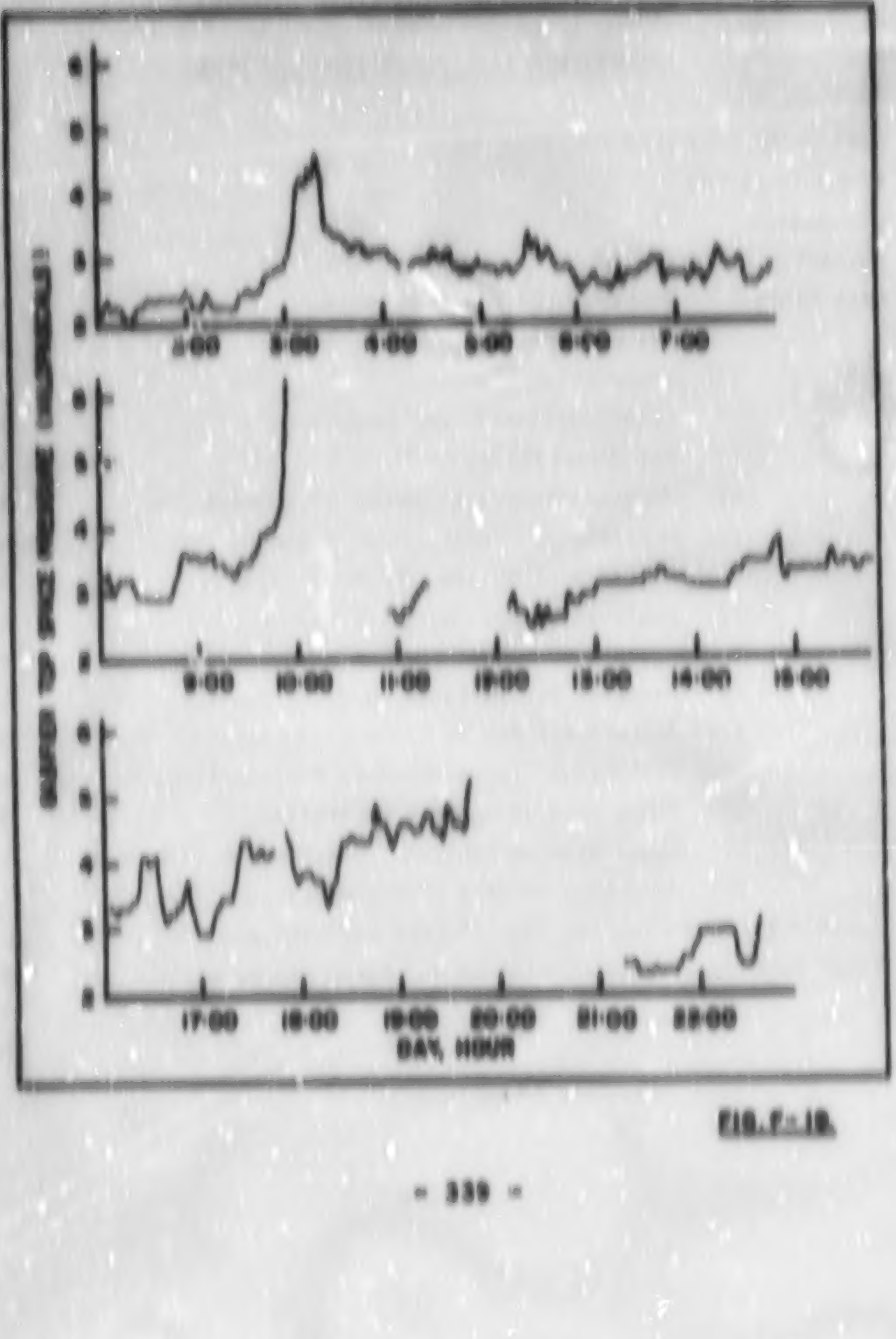

FIG. F-19.

APPENDIX G

CAFB RUN 9

OPERATIONAL LOG, INSPECTION AND DATA

PAGE

Pre-run Explosion in Gasifier Unit. 341

Operational Log. 347

Inspection 357

Inspection, Figures G1-G22 360

Data Table I Temperatures and Feed Rates. 374

II Gas Flow Rate. 390

III Pressures. 408

IV Desulphurisation Performance. 424

V Gas Composition. 440

VI Sulphur and Stone Cumulative Balance. 461

VII Analysis of Solids, Total Sulphur. 482

VIII Analysis of Solids, Sulphate Sulphur. 485

IX Analysis of Solids, Total Carbon. 488

X Solids Removed. 491

XI Gasifier Bed Particle Distribution. 493

XII Regenerator Bed Particle Distribution. 503

XIII Elutriator Coarse Particle Distribution. 507

XIV Stone Feed Particle Distribution. 510

XV Trace Element Analysis by Neutron Activation. 512

XVI Spark-Source Mass Spectrometric Analysis. 514

Figure G-23 Chronological Plot of Unit Performance. 528

Figure G-24 Chronological Plot of Gas Space Pressure. 531

APPENDIX Q

CAFB RUN 9

PRE-RUN EXPLOSION IN GASIFIER UNIT

On the morning of 22nd October 1974, an explosion occurred in the gasifier during attempts to check out and set up the start-up burner in the preparation for Run 9. Extensive damage to the unit occurred which delayed the start of the run by about two weeks. Figures Q-1 and Q-2 shows the damage done to the gasifier lid which was completely lifted by the explosion, whereas Figures Q-3 and Q-4 show the large cracks in the gasifier refractory. Damage to the cyclones also occurred as shown in Figures Q-5 and Q-6.

An inquiry was convened to find out the cause of the explosion, and various action points identified to prevent a re-occurrence. A detailed description of the events leading up to the explosion, and recommendations for future procedures is contained in a file note written by the investigating committee and is incorporated in this Appendix.

APPENDIX G

CAFB GASIFIER EXPLOSION - 22nd OCTOBER 1974

WHAT HAPPENED

After usual calibration checks of flowmeters the pilot flame of the gasifier was lit and established, and then main flame light-up attempted, unsuccessfully.

Air purging was maintained for about 10 minutes, passing about 30 volumes of air through the gasifier, and then re-lighting was attempted.

After the pilot was established, the main burner light-up was attempted, and appeared to have been established, but with a rather yellow flame. When the gas flow was reduced to increase air/fuel ratio and rectify flame yellowing there was an immediate explosion which lifted the 350 lb. gasifier lid, cracked the refractory walls and moved the cyclone off-takes.

The operators reacted calmly, confirming that nobody was hurt, and making safe by cutting off the gas supply to the building. Their early concern was on how quickly could the problem be solved so that the run might proceed as planned.

Damage caused by thr incident will be rectified by 4th November, though the effectiveness of tur repair of the refractory lining can only be assessed when the gasifier is next heated up.

ANALYSIS OF EVENTS

All operators had been following standard operating instructions.

The control settings of the flow meters were re-checked and found to be correct for the propane gas, but somewhat different from the pre-explosion records for air. This may be due to disturbance by the explosion since manometer fluid was found in the lines. However, the gas air mixture would still have been flammable, both before and after the adjustment which initiated the explosion (stoichiometric air : fuel ratios being 1.5 : 1 and 2.3:1 respectively).

It was also found that the fire eye controller was set to retain a pilot flame throughout operation, and not to shut down the pilot flame once the main flame was established. The controller can see flames, but not distinguish between pilot flame and main flame. This was as the result of a considered decision sometime ago to minimise shut-downs due to transitory flame failure.

It was, therefore, concluded that:

(a) The pilot flame did not ignite the main flame.

(b) The fire eye controller did not recognise that the main flame had not been established, and so allowed flammable gas mixture to fill the gasifier.

(c) Disturbance of the gas flume caused ignition to occur from the pilot which led to explosion.

These conclusions are the only ones we could reach which would explain the facts, but we do not have positive evidence.

	ACTION PROPOSED WITH CAPD GASIFIER	ACTION
	The actions proposed are:	
1.	Modify fire eye controller to cut out the pilot flame 5 seconds after the main gas is admitted (so allowing the fire eye to detect presence or absence of the main flame).	Done
2.	As a back-up to the pilot solenoid a manual pilot isolating valve will be installed.	Done
3.	An MSA gas detector will be installed in the pit and connected to an alarm.	GLJ/MD
4.	Install alternative valve in Stordy Hauck burner gas piping to make it fully controllable for use with propane, since although it was supplied against specification for propane, it has been found that the main gas supply pipe and valve is sized for towns gas, of which five times the volume is required.	Temporary modification for this run; change afterwards

		ACTION
5.	Re-site solenoid valve nearer to burner.	GLJ before this run if possible
6.	Check that the CAFB gasifier warm up system complies with the Code of Practice recommendations of the Gas Council which was issued after the CAFB system was designed, or that safety hazards are not caused by discrepancies from the code.	Done
7.	Provide better proof of air flow to the gas burner by replacing the pressure switch in the air line connected to the fire eye by an orifice flowmeter connected to the fire eye.	GLJ after this run
8.	Provide for cleaning the fire eye sight glasses more frequently.	Done
9.	Ensure two men present at all times during gasifier warm up.	Done
10.	Incorporate appropriately all of the above actions in a revised set of written operating instructions.	GLJ in hand
11.	Give a training session to the operators incorporating these changes.	GLJ in hand

IMPLICATION WITH CAFB BOILER

The CAFB boiler is different from conventional boilers in that the fuel gas is of unknown and changing composition at the time of light-up.

Just prior to light-up the boiler is being purged by passage of inert gas from stoichiometric combustion in the gasifier. For light-up of the boiler additional fuel oil is passed into the fluidised bed of the gasifier causing a combination of:

(a) direct vaporisation of volatiles.

(b) cracking with formation of further volatiles and deposits of carbon.

(c) burning of carbon deposits in lower parts of the bed to generate further combustible gas.

These processes take place at different rates, and although it takes about 6 minutes for the gas to reach maximum richness, it is very difficult to estimate exactly when the gas entering the boiler reaches flammable limits, though best estimates of composition and experience on light-up put it at about 6 seconds. The significance of this is that only about 3 seconds flow of flammable gas should be allowed without successful ignition, before aborting the operation to avoid explosion hazard, but the start of the 3 seconds is not known within ±2 seconds. In practice, it has taken less than 10 seconds between when the fuel oil pumps to the gasifier have been switched on and there has been ignition in the boiler.

The recent incident involved explosion of about 1,000 Btu's of gas in the gasifier. The boiler when full would contain approximately 6,000 Btu's of gas.

	ACTION PROPOSED WITH CAFB BOILER	ACTION
1.	Modify the instructions to allow maximum 9 seconds to prove the main flame on the boiler before aborting (before next run).	In hand
2.	During start-up there should be no personnel in the hall, and nobody should be allowed to approach the back door of the boiler until the main flame has been proved. The sliding doors at the back of the boiler should be open, and nobody should be allowed to approach the neighbourhood of these doors from the outside.	In hand
3.	Ensure that any recommendations for safe operation arising from operation of the CAFB pilot plant should be fed into the EPA programme.	GLJ after this run

SITE-WIDE ACTION		ACTION
1.	Check on all burners at BRGA to confirm that a main flame failure will result in a positive automatic shutdown.	RD

All actions "in hand" will be completed before start-up.

R. Duval　　　　G. L. Johnes　　　　R. W. Vickers

RWV/MBM
1.11.78.

APPENDIX G

CAFB RUN 9

OPERATIONAL LOG

4.11.74. to 8.5.74. (Unit Warm Up)

Warm up of the unit started at 15.00 on 4.11.74., and the temperature was progressively raised by about 50°C per hour. At a unit temperature slightly in excess of 500°C, carbon in the cyclones and ducts laid down from the previous run caught fire and the temperatures in that region rose rapidly. Sparks of glowing carbon were clearly visible through the sight glass at the back of the boiler. The burn-out lasted for approximately one hour after which temperatures dropped to normal.

At 10.15 on 6.11.74., kerosine was introduced (unit temperature ~ 700°C), and the propane progressively backed off. Stone addition started at midnight on the same day initially using bed material recovered from the previous run. Several minor leaks in the cyclone ducts and gasifier lid were sealed with Sairset fireclay.

A switch to fuel oil combustion was made at 13.20 on 8.11.74. prior to gasification at 19.00.

Throughout the period of warm up the usual minor teething problems again occurred. The warm up propane burner was again subject to frequent flame outs due to condensation of water in the fire eyes until N_2 purges were fitted.

8.11.74. (Day 1 of Gasification)

Approximately two hours after initial start-up on gasification the automatic shutdown system was activated by an electrical fault in the 12 volt supply to the pulsers and alarm relays. In the absence of fuel oil, runaway regeneration of the bed material occurred resulting in a rapid rise in bed temperature to levels in excess of 1,000°C. To halt the temperature rise the bed was slumped.

9.11.74. (Day 2)

Shortly after midnight the gasifier plenum air was restarted and the bed material initially warmed up on kerosine combustion before transferring to heavy fuel oil combustion. Gasification recommenced at 01.35.

At 06.00, the flue gas analysis sampling line was replaced by a new sampling line using a porous aluminite probe inserted into the boiler flame. It was hoped this new sampling method would avoid the problems associated with SO_2 pick up by the glass wool filter in the old system. No change in the flue gas analysis was observed on change over to the new system.

Throughout the day trouble was experienced with the fines return system.

10.11.79. (Day 3)

Shortly after midnight a high gasifier lid pressure was observed (c.6 kilopascals) and both the air flow and fuel flows were reduced to alleviate this while preparing to attempt an on-line decoke. However, at 01.40 a main flame failure caused a change in plans and instead sulphation followed by slumped bed decoke was carried out.

Before the decoke was carried out the new flue gas sampling probe was partially withdrawn to allow a clear view of the gasifier to burner duct. Unfortunately during this operation the aluminite sheath became detached from the Firebird white tube and dropped off inside the boiler. The old sampling system was restored while a replacement sheath was found.

Throughout the day the bed material was maintained at gasification temperatures by periodically operating on kerosine combustion. Meanwhile various repair and maintenance jobs were carried out including a boiler clean out.

11.11.79. (Day 4)

Gasification was restarted at 01.10 and continued till 10.05 when an electrical fault caused a brief shutdown of one hour duration.

Minor problems encountered were regenerator sampling line and stone feed blockages. The bottom fuel injector also blocked.

A new silumanite probe was fitted and the new flue gas sampling method resumed.

12.11.74. (Day 5)

Problems with the fines return system re-occurred throughout the day. High stone feed rates were used to increase bed depth and this resulted in the need to periodically clean the feed hopper system to remove fine material which caused blockages.

At 19.55, air was introduced below the gasifier lid to try to minimise the rate of pressure rise due to lay down of coke. The rate of air injection was progressively increased to 1,250 litres/minute, while the burner premix air was reduced to compensate.

13.11.74. (Day 6)

Early in the day the flue gas sampling system was replaced because the silumanite probe became blocked. This new system was obviously not an improvement and was discarded for the rest of the run.

At 21.40 a main flame failure occurred for no apparent reason.

14.11.74. (Day 7)

Gasification restarted at 00.30 after the fuel injection pumps were flushed with hot oil to reduce the initial pressure build-up.

After a period of several days trying to raise the bed level, it became evident that the stone feed material was too fine and most of the feed was not being retained by the bed. A change was made to a coarser fraction of stone.

During the earlier shutdown period the air to the lid was shut off and this was re-introduced at the same rate at 10.30.

15.11.74. (Day 8)

An uneventful day, but the high gas space pressure necessitated a shutdown for a slumped bed decoke at 22.30. This was carried out without prior sulphation.

16.11.74. (Day 9)

After a successful decoke, gasification was resumed at 02.30 and unlike previous occasions when sulphation was carried out, desulphurisation was immediate.

At 03.30 the pressurisation unit for the boiler failed and activated the automatic shutdown sequence. The motor on the autovalve controlling the water flow to the cooling tower failed in the closed position resulting in all the cooling water being fed to the cooling tower irrespective of the boiler water temperature.

Gasification restarted at 05.50 and proceeded until 21.15, when loss of pressure in the pressurisation unit again caused a shutdown. At 21.50 a restart was attempted, but failed to get ignition even after twenty seconds. A second attempt was also abortive, this time attributed to the presence of cold fuel in the fuel line. However, after two more abortive attempts a fire valve in the fuel line was found to be closed.

17.11.74. (Day 10)

Gasification began again at 01.55. The experiment of air injection to the lid was continued.

A few minor problems occurred throughout the day, but on the whole a good day's gasification.

18.11.74. (Day 11)

A restriction in the gasifier to regenerator transfer line resulted in a period of poor regenerator performance. A high bed depth in the regenerator could not be maintained, and difficulty was experienced in keeping the regenerator temperature below 1,075°C. The transfer line was rodded out and regenerator performance improved.

A desulphurising performance of 85% was considered poor at a bed depth of ~110 mm, and it was decided to test conditions with high levels of bed carbon. One theory put forward for the poor performance was that the air to the lid may be causing some regeneration of the stone above the bed. This was tested by switching off the air, but the flue gas SO_2 levels remained constant, and therefore the air to the lid was restored.

19.11.75. (Day 12)

Sulphur removal efficiency had levelled out at [illegible], and attempts to improve this value by increasing bed carbon levels had failed. The unit was now operated at low Ca/S mole feed ratios to assess the effect of this variable. Operation in this way continued throughout the day.

20.11.75. (Day 13)

Gasification continued smoothly until 19.00 when a high gasifier lid pressure necessitated a shutdown and burn-out.

At 21.00 gasification was resumed, and immediately both cyclone drain systems were found to be inoperative due to cyclone blockage as a result of the burn-out. Both systems were rodded out and a large amount of carbonaceous material removed.

21.11.75. (Day 14)

The back of the boiler was cleaned out shortly after midnight, and about 250 kg of stone removed.

Problems with cyclone blockages and control of regenerator temperature featured throughout the day. Low Ca/S molar feed rates were continued.

22.11.75. (Day 15)

The unit was performing well but the gasifier lid pressure was high and steam/air injection above the bed was tried for a period of three hours to try to decoke the system.

This approach was unsuccessful and the unit was shutdown at 16.50 to carry out a steam/air slumped bed decoke.

Gasification was restarted at 22.50 and once more both cyclones were found to be blocked from the debris accumulated during the decoke.

23.11.75. (Day 16)

The initial problems with blocked cyclones was finally resolved and conditions were set up to test high bed velocities ($\sim$1.5 m/s). A limiting factor in this study was the high distributor pressure drop due to lime build up below the distributor.

At 15.45, a main flame failure occurred. The oil pressure in the main fuel pump was showing zero, although apparently the main supply tank was far from empty. However, a switch to an alternative supply tank resulted in a successful restart at 16.50.

Conditions were set up to test the effect of air/fuel ratio at high bed velocities.

At 22.15, steady drops of oil were discovered leaking from the bottom of the unit and a can was positioned to collect it.

24.11.75. (Day 17)

A main flame failure occurred at 00.30 and the fire eyes were checked and cleaned, and gasification restarted at 01.10.

At 12.50 tests involving H_2S injection into the middle of the gasifier bed through a central tapping were carried out. This was continued till 14.45 after which gasifier and regenerator stone samples were taken for analysis. The test was repeated at 19.16 for thirty minutes. Throughout both test periods no change in flue gas SO_2 levels was noted indicating complete absorption of H_2S sulphur by the bed.

A similar test with SO_2 injection was carried out at 20.07 for thirty minutes duration, and again complete absorption of the sulphur from the additive was obtained.

25.11.75. (Day 18)

The unit was deliberately run under fuel rich conditions (A/F ~ 21%) to test sulphur removal efficiency at high carbon levels on the bed limestone. This led to high CO_2 levels and low SO_2 levels in the regenerator tail gas.

Later conditions were established with air/fuel ratio around 20%, and regenerator performance was restored. The unit was operating at a high gasifier lid pressure (~ 6 kilopascals).

26.11.74. (Day 19)

At 01.00 a main flame failure occurred, but a restart was made after ten minutes. However, both cyclones were blocked.

At 14.15 an electrical power failure produced a fifteen minutes shutdown.

27.11.74. (Day 20)

The stone feed to the gasifier was changed from BCR 1359 to Aragonite. The sulphur removal performance seemed to improve with the new stone, but the flue gas sampling line required frequent attention due to blockage by a fine white powder. Furthermore difficulty was experienced in maintaining bed depth despite a high stone feed addition (Ca/S 1.5 m). This indicated rapid attrition in the bed and a large amount of material lost to the boiler as fines.

At 21.15 the high gasifier lid pressure necessitated a shutdown for a slump bed decoke.

28.11.74. (Day 21)

Gasification was restarted at 04.30 and again cyclone blockage problems were encountered. A main flame failure occurred at 09.30, and gasification was again resumed at 12.45. BCR 1359 was used instead of Aragonite as the stone feed.

Another flame failure occurred at 15.30 without apparent reason, and gasification was restarted at 20.20. While in the process of cleaning the cyclone drain system the central fuel injector, which had been blocked and not in use for sometime, suddenly burned out and hot bed material escaped from the unit onto the pit floor. The unit was shutdown and the injector blanked off.

29.11.74. (Day 22)

After a number of abortive start-up attempts, gasification finally got underway at 08.00.

Once stable conditions were established the fuel supply was gradually reduced in order to increase bed temperature and explore the effect of this variable on sulphur removal efficiency.

30.11.74. (Day 23)

The flue gas SO_2 level remained fairly constant with increasing bed temperature until 980°C when the level increased.

At 11.50 the regenerator temperature was operated at 1,130°C without any apparent ill effects.

1.12.74. (Day 24)

Early tests with high regenerator temperatures 1,100-1,200°C, and high regenerator SO_2 and lower SO_2 tail gases were completed by 09.00, and the regenerated temperature was restored to a more normal level (~ 1,060°C).

Attempts to increase bed depth above ~110 cm were thwarted by cyclone blockages due to the high stone circulation at deeper beds.

2.12.74. (Day 25)

Throughout the morning problems with cyclone blockages occurred and at 17.55 the unit was shutdown prior to a slump bed burn-out. Gasification restarted at 22.00.

3.12.74. (Day 26)

Early in the day the unit was lined out at a high air/fuel ratio (~20%), but progressive blockage of the gasifier distribution resulted in a reduction in air supply and fuel rich conditions in the gasifier.

In order to clean out the distributor the bed was partially drained, the unit shutdown and the remaining bed sulphated. Approximately 40 kg of material was removed from below the distributor.

The regenerator distributor was similarly cleaned out and the unit restarted at 20.35.

4.12.74. (Day 27)

To maintain a good circulation of fines in the system, the unit was operated at a high stone feed with alternate supplies of sieved and unsieved stone.

The effect of thiophene injection was tested at 19.36 by introducing the liquid into the bed through a central tapping.

5.12.74. (Day 28)

Experiments with air injection into the gasifier upper manometer tapping were carried out at various times throughout the day. It soon became clear that the blast of air was breaking up the stone and generating fine material. Evidence for this came from the increase in the cyclone drain temperatures. Also evident was an improvement in sulphur removal efficiency which persisted even when the stone feed was reduced to zero.

Unfortunately, prolonged testing under these conditions was curtailed by the distributor again progressively blocking up causing a drop in bed velocity, and the need to shutdown before a loss in fluidisation occurred.

6.12.74. (Day 29)

At 00.20 the unit was shutdown and sulphation began. After this was completed the bed was slumped and the underside of the distributor cleaned out. Approximately 30 kg of stone was removed.

Flue gas and air was then introduced above the bed to decoke the system.

Gasification was restarted at 22.15.

7.12.74. (Day 30)

Initially the unit was operated at high bed velocity (1.5 m/sec.) and a shallow bed (~75 cm), but the sulphur removal efficiency was low and consequently the bed velocity was reduced, the stone feed rate increased in order to raise bed depth, and the air jet restored to the middle of the bed. Almost immediately % SRE improved.

Throughout the day the effect of bed depth was explored by progressively withdrawing bed material and studying performance.

An attempt to control the circulation of fines by injecting steam above the bed proved unsuccessful.

8.12.75. (Day 31)

Instead of steam injection above the bed, N_2 injection was tried but this too had no effect on performance.

Various attempts to improve performance by increasing the fines circulation rate were carried out, culminating in the use of Aragonite stone.

A good % SRE performance was obtained with Aragonite stone, but it soon became obvious that this performance was artificially good because of Aragonite contaminating the sampling filter.

9.12.75. (Day 32)

At 09.30 the gasifier top space pressure was high and, therefore, it was decided to shutdown the unit and carry out a slumped bed decoke.

APPENDIX Q

CAFB RUN 9

INSPECTION

Gasifier and Regenerator Refractory

At the end of Run 9, a slumped bed decoke was carried out, and hence the state of the unit on subsequent inspection reflects the efficiency of this procedure. Figures Q-1, Q-2, & Q-3 show various views of the gasifier unit after stripdown. This shows the remarkably clean condition of the refractory walls and also that the sealing material in the cracks from the pre-run explosion was still intact.

However, close inspection indicated the Sairset sealing material had become friable, loose and obviously far from leak tight. Presumably, during gasification the cracks were effectively sealed by carbon laid down from the process, and this would account for the observation of some leakage immediately after a slumped bed decoke which disappeared after several hours operation.

The view of the gasifier bed material (Figure Q-4) shows a piece of asbestos rope and odd fragments of carbon which dropped on the bed during the removal operation. Otherwise the bed was generally free of agglomerates and homogeneous throughout its depth.

A notable exception to this was a large lump of fused limestone of the general shape of the transfer line 'post box' which was resting on the plenum immediately below the 'post box'. This may have been formed during the run when the transfer line was rodded out after an operational malfunction tripped the N_2 supply and caused air to be supplied to the injectors for a brief period.

The regenerator bore was generally clean, but oil markings on the wall coincided with the height of the steel floor of the unit suggesting the point of seepage of fuel oil from the gasifier. At the top of the regenerator, where the bore diameter was restricted, material was laid down causing a partial blockage.

Gasifier and Regenerator Distributors

Some difficulty was experienced in removing the gasifier distributor during the dismantling process. This was probably a result of the tarry material surrounding the distributor. Figure G-10 gives a side view of the distributor showing the extensive seepage of oil. The condition of the distributor air nozzles is shown in Figure G-11. Approximately a third of the air nozzles were blocked or partially blocked, and there was some evidence of oil seepage downwards through two of them.

The aperture between the bottom plate and the regenerator distributor was completely filled with tarry material. Figure G-12 gives a view of the regenerator distributor which was in a reasonably good condition with only one blocked air hole.

Gasifier and Regenerator Penetrations

The fuel injector projecting through the distributor at the bottom of the gasifier was burnt off at the fuel outlet holes and also 12" below this point. One of the side injectors was also burnt away. The gasifier thermocouples had distorted outer metal sheaths and some burnt surface damage.

All three regenerator thermocouples had fractured ends, although this may have resulted from falling material during the removal of the distributor. The regenerator outlet refractory block housed inside flexible bellows was fractured into two and the bellows also showed some damage.

Gasifier/Regenerator Transfer Line Agitators and Injectors

The left hand agitator was distorted, and the angled outlet hole partially blocked. The right hand agitator was also distorted, but clear. Both injector holes were clear.

Gasifier Outlet to Cyclones

Figures G-13 & G-14 show two views of the outlet from the gasifier to the cyclones.

Some deposits in the zone between the two outlet ducts is clearly shown, but the passages themselves are remarkably clean.

Gasifier Cyclones

Photographs of the condition of the cyclones are given in Figures G-15–G-16. The refractory walls appear to be reasonably clean, but evidence for the extent of carbon laid down prior to the slump bed decoke comes from the large flakes of carbon visible at the bottom of the cyclone. This material was probably responsible for the cyclone drain blockages experienced on restart after a slump bed decoke.

The silicon carbide tubes shown in Figures G-17, and G-18 were covered with white flaky material. Figure G-18 clearly shows the refractory block, which carries the silicon carbon tube of the right hand cyclone, was fractured into two pieces. However, the refractory block which was located inside the flexible bellows was intact despite having to be jointed with Sairset prior to the run.

Main Burner

The central steel tube of the burner had two cracks approximately 1" in length, and also the edge of tube was burnt away. Figures G-19,& G-20 show this clearly.

Boiler

Figure G-21 gives a general view of the back of the boiler with the door open. This shows a sizeable quantity of lime particles, some of which were quite coarse indicating that the cyclones had not been very effective over part of the operational period. The entries into the first tube pass were coated, and in some cases completely blocked by a thick layer of lime deposit. Figure G-22 shows a close-up view of the fire tube leading down to the burner at the far end.

Approximately 198 kgs (436 lbs.) of material was removed from the boiler back end, 75 kgs (165 lbs.) from the boiler front plenum and a further 59 kgs (130 lbs.) from the boiler furnace tubes.

Fig. G-1 Gasifier Lid Damage after Pre-run Explosion

Fig. G-2 Gasifier Lid Damage after Pre-run Explosion (second view)

Fig. G-3 View of Refractory Cracks after Pre-run Explosion

Fig. G-4 View of Refractory Cracks after Pre-run Explosion (second view)

Fig. G-6 Damage to Cyclones after Pre-run Explosion

Fig. G-6 Damage to Cyclones after Pre-run Explosion

Fig. G-7 View of Gasifier after stripdown

Fig. G-8 View of Gasifier after Stripdown

Fig. G-9 View of Gasifier after Stripdown

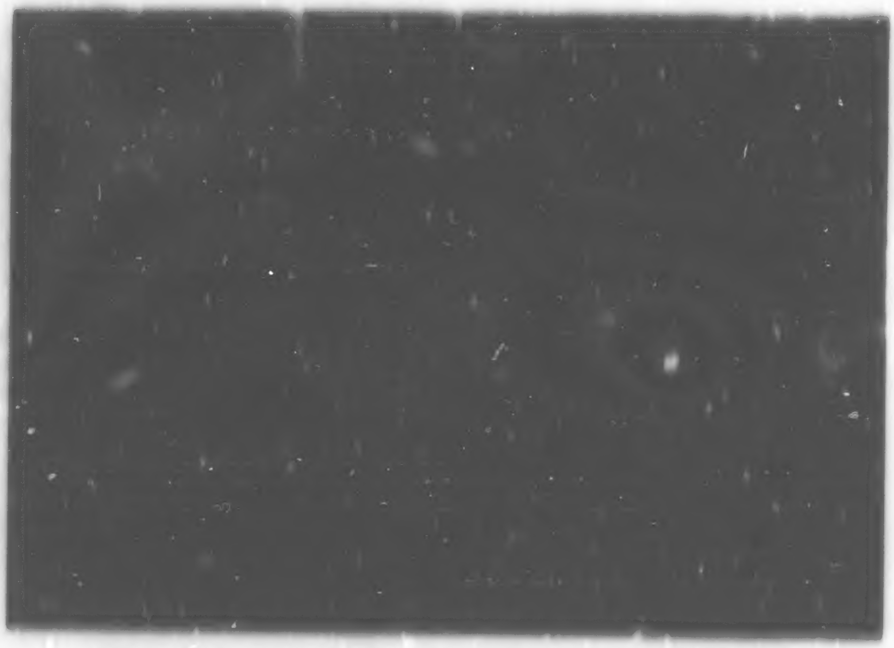

Fig. G-10 Side View of Gasifier Distributor

Fig. G-11 Condition of Gasifier Distributor Air Nozzles

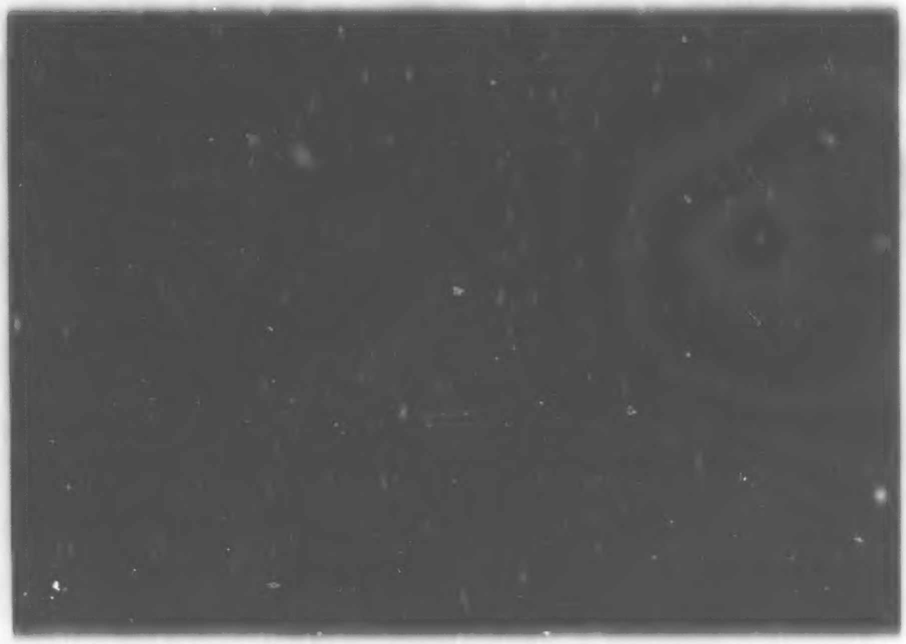

Fig. G-12 View of Regenerator Distributor

Fig. G-13 View of Cyclone Entry Ducts

Fig. G-14 View of Left Hand Cyclone Entry Duct.

Fig G-15 View of Left Hand Cyclone

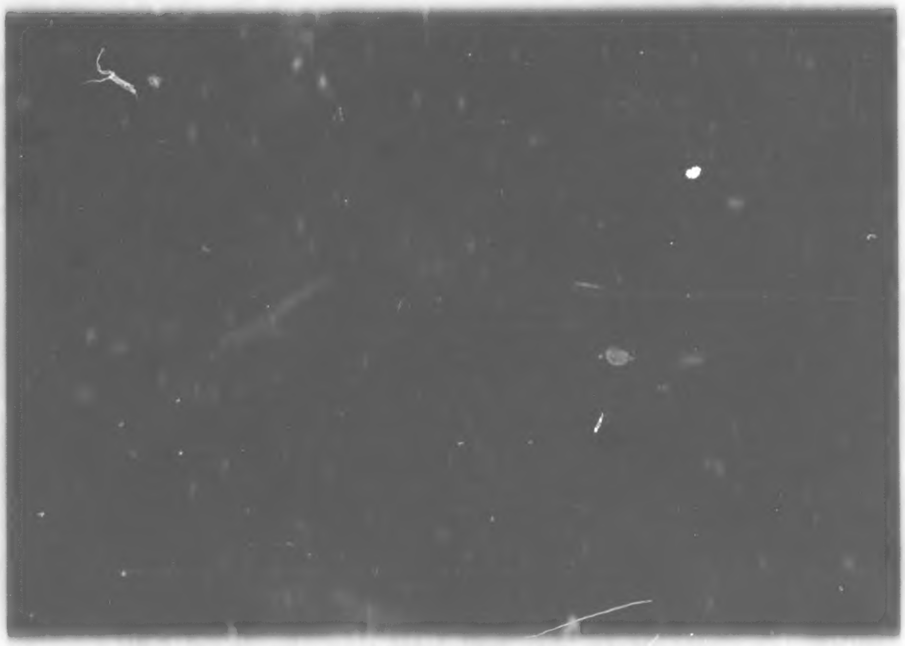

Fig G-16 View of Right Hand Cyclone

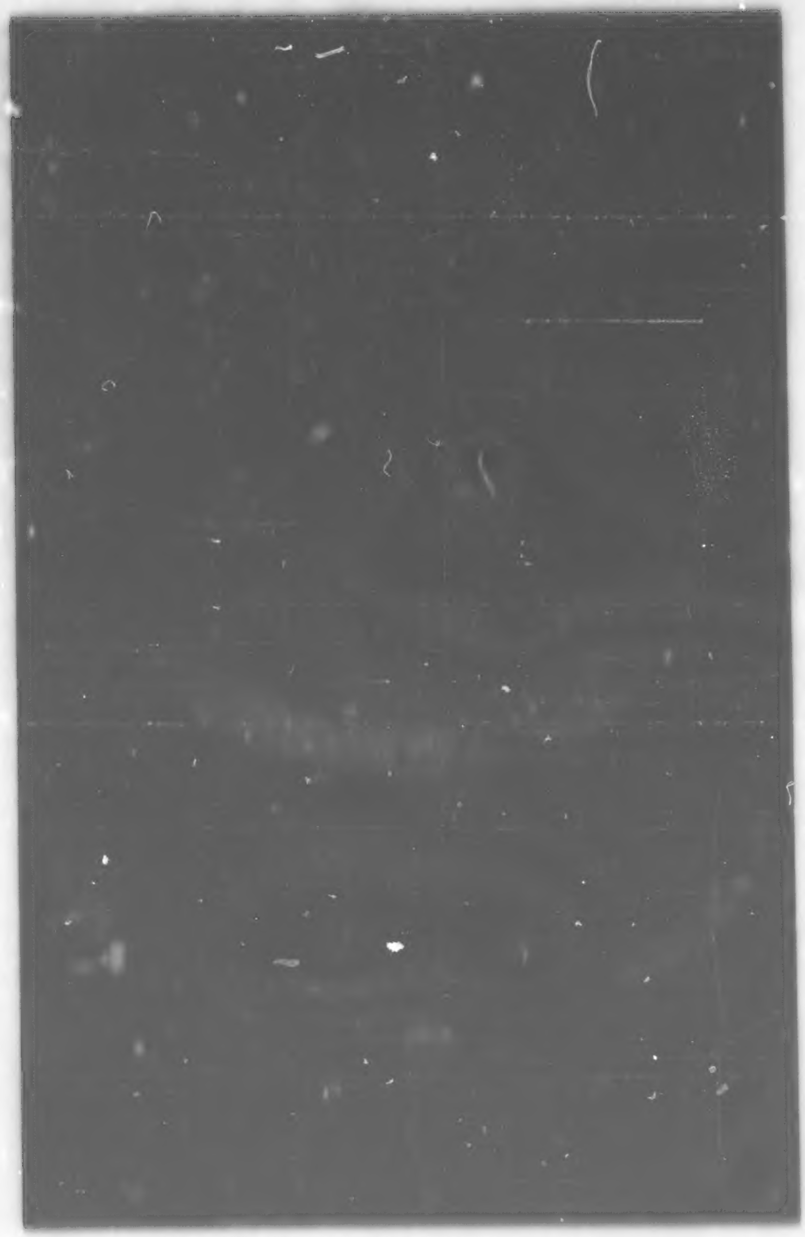

Fig G-17 View of Left Hand Cyclone Offtake Tube

Fig C-18 View of Right Hand Cyclone Offtake Tube

Fig G-19 View of Main Burner Central Steel Tube

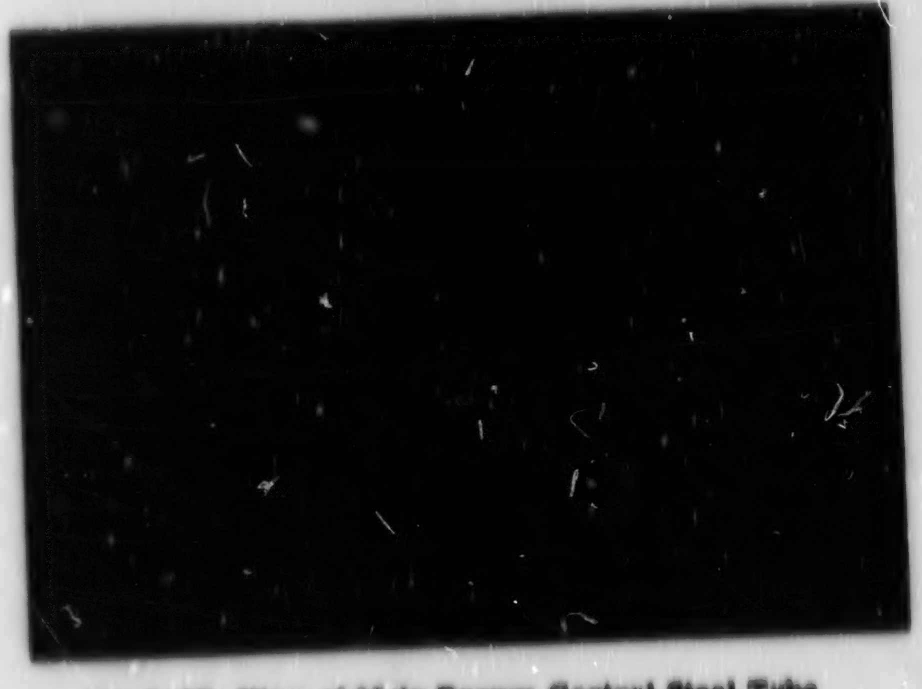

Fig G-20 View of Main Burner Central Steel Tube

Fig C-21 General View of Back of Boiler

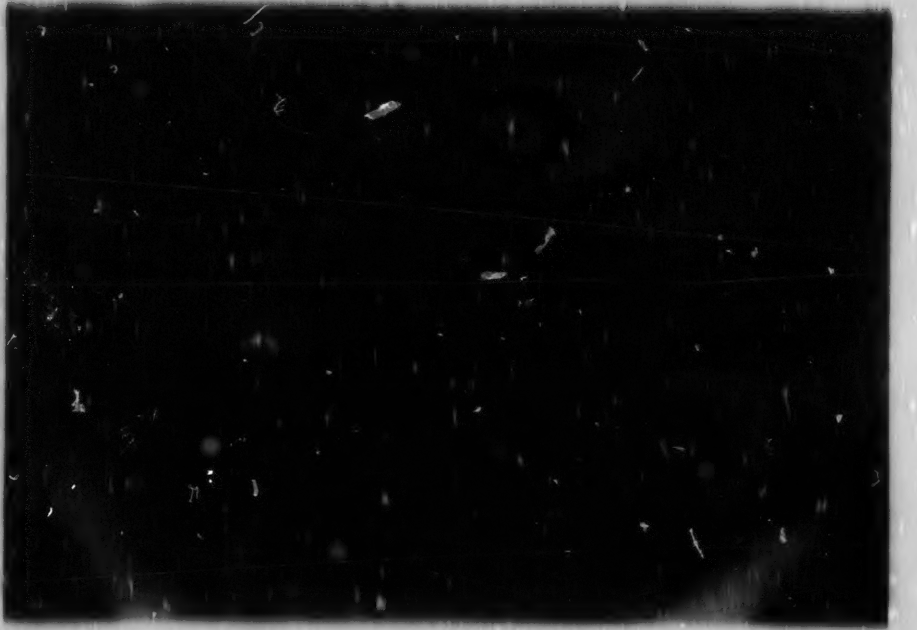

Fig G-33 Close up view of Boiler Fire Tube

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                    APPENDIX C, TABLE 1.
   RUN 9:  TEMPERATURES AND FEED RATES    PAGE  1 OF 16

DAY:HOUR      TEMPERATURE, DEG. C.         FEED RATE KG/HR
          GASIFIER   REGEN.  RECYCLE        OIL       STONE

 1:1930      980.      1040.        0.      150.1        0.0
 1:2030      930.      1000.        0.      147.1        0.0
 1:2130      925.       960.        0.      145.1        4.5

     SHUT DOWN AT  1:2130 FOR   4 HOURS

 2:0230      750.      1000.       50.      147.4        0.
 2:0330      951.      1005.       50.      163.8       10.1
 2:0430      935.       990.       50.      133.3       26.3
 2:0530      983.       975.       50.      194.7       24.5
 2:0630      887.       965.       50.      151.9       20.0
 2:0730      885.       950.       50.      161.0       25.4
 2:0830      980.       970.       45.      169.6        3.6
 2:0930      920.      1000.       30.      168.0        0.7
 2:1030      937.      1030.       35.      173.7        6.0
 2:1130      925.      1050.       35.      180.0        3.4
 2:1230      983.      1058.       40.      184.0        3.6
 2:1330      912.      1055.       40.      183.0        4.5
 2:1430      890.      1055.       40.      187.7        4.5
 2:1530      880.      1050.       40.      188.5       13.0
 2:1630      895.      1040.       30.      188.5       10.0
 2:1730      880.      1040.       30.      188.5       26.0
 2:1830      984.      1040.       34.      189.0       17.7
 2:1930      895.      1045.       34.      186.1       10.0
 2:2030      870.      1045.       32.      184.0       21.0
 2:2130      900.      1050.       30.      179.1       13.6
 2:2230      900.      1055.       30.      186.9       11.3
 2:2330      900.      1055.       30.      185.7       14.1

     SHUT DOWN AT  2:2330 FOR  28 HOURS

 4:0430      885.       940.       55.      156.0        3.6
 4:0530      875.       990.       53.      156.0       17.0
 4:0630      875.      1040.       59.      156.0       19.1
 4:0730      985.      1040.       50.      155.0       20.9
 4:0830      985.      1033.       49.      156.4       15.9
 4:0930      890.      1030.       45.      156.0       20.0
 4:1030              MISSED DATA READING
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APPENDIX G. TABLE I.

RUN 9: TEMPERATURES AND FEED RATES PAGE 2 OF 16

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
4:1230	910.	1013.	60.	147.0	11.0
4:1330	896.	1008.	50.	139.6	14.5
4:1430	890.	1036.	50.	140.0	17.2
4:1530	903.	1040.	60.	141.0	6.6
4:1630	903.	1042.	50.	140.4	3.6
4:1730	890.	1045.	62.	140.4	5.4
4:1830	880.	1040.	50.	140.0	22.7
4:1930	880.	1046.	60.	140.0	32.9
4:2030	884.	1040.	62.	140.4	33.6
4:2130	905.	1050.	62.	142.4	23.6
4:2230	915.	1050.	60.	138.7	9.1
4:2330	905.	1050.	60.	141.2	32.4
5:0030	900.	1050.	60.	144.1	14.5
5:0130	900.	1070.	60.	140.0	25.4
5:0230	900.	1065.	60.	135.0	18.1
5:0330	920.	1075.	50.	142.6	18.6
5:0430	910.	1040.	50.	139.6	25.9
5:0530	910.	1040.	50.	139.6	11.0
5:0630	890.	1045.	50.	140.4	29.5
5:0730	905.	1045.	55.	141.6	23.3
5:0830	903.	1040.	55.	137.1	14.5
5:0930	896.	1040.	50.	141.2	24.0
5:1030	891.	1035.	50.	140.4	15.0
5:1130	891.	1040.	60.	140.4	24.2
5:1230	900.	1055.	60.	135.0	22.7
5:1330	900.	1040.	60.	140.4	25.4
5:1430	909.	1045.	65.	140.0	25.4
5:1530	900.	1050.	62.	140.0	15.9
5:1630	896.	1046.	62.	140.4	17.0
5:1730	885.	1042.	60.	140.0	20.9
5:1830	905.	1040.	62.	140.0	12.2
5:1930	900.	1042.	62.	140.4	22.0
5:2030	880.	1040.	62.	141.2	31.0
5:2130	905.	1040.	62.	144.9	44.9
5:2230	900.	1040.	60.	136.3	36.3
5:2330	915.	1040.	62.	140.0	18.6
6:0030	885.	1040.	62.	140.4	40.1
6:0130	900.	1045.	62.	140.0	30.1
6:0230	905.	1040.	60.	140.4	39.5
6:0330	905.	1040.	62.	140.4	30.9

APPENDIX G: TABLE 1.
RUN 9: TEMPERATURES AND FEED RATES PAGE 3 OF 16

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
6:0430	885.	1040.	60.	140.4	41.7
6:0530	890.	1040.	62.	140.4	45.5
6:0630	880.	1040.	60.	142.5	49.0
6:0730	906.	1040.	60.	137.9	44.9
6:0830	890.	1040.	60.	140.4	54.6
6:0930	905.	1040.	60.	139.1	40.8
6:1030	905.	1040.	60.	139.1	45.0
6:1130	890.	1070.	62.	140.4	30.1
6:1230	883.	1015.	60.	140.0	60.1
6:1330	910.	1040.	60.	147.4	46.3
6:1430	900.	1030.	60.	140.4	51.3
6:1530	871.	1040.	60.	140.4	30.0
6:1630	900.	1046.	60.	137.9	22.2
6:1730	900.	1070.	60.	147.0	33.1
6:1830	880.	900.	60.	141.2	22.2
6:1930	880.	920.	58.	136.7	0.
6:2030	880.	1000.	58.	136.7	0.

SHUT DOWN AT 6:2030 FOR 4 HOURS

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
7:0130	850.	1050.	60.	160.4	0.
7:0230	900.	1055.	38.	167.5	0.9
7:0330	935.	1060.	30.	165.9	11.0
7:0430	935.	1045.	30.	166.3	12.7
7:0530	914.	1043.	30.	166.3	19.1
7:0630	912.	1042.	35.	166.3	18.7
7:0730	900.	1042.	35.	166.3	18.7
7:0830	896.	1042.	35.	166.3	17.7
7:0930	905.	1040.	35.	170.1	15.0
7:1030	905.	1040.	35.	161.8	6.0
7:1130	900.	1040.	35.	164.7	5.4
7:1230	910.	1040.	35.	168.0	5.9
7:1330	902.	1040.	35.	164.5	10.7
7:1430	894.	1040.	35.	167.1	17.6
7:1530	915.	1040.	35.	165.5	74.4
7:1630	865.	1040.	35.	160.0	57.2
7:1730	860.	1040.	35.	157.0	50.1
7:1830	870.	1040.	30.	155.2	46.3
7:1930	860.	1040.	30.	151.9	30.0

APPENDIX G: TABLE 1.
RUN 9: TEMPERATURES AND FEED RATES   PAGE 4 OF 16

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
7:2030	880.	1040.	30.	149.0	20.5
7:2130	900.	1043.	10.	156.4	19.5
7:2230	910.	1043.	30.	150.3	19.1
7:2330	910.	1040.	35.	147.2	19.5
8:0030	910.	1042.	0.	151.9	22.9
8:0130	910.	1040.	0.	150.7	17.7
8:0230	910.	1043.	0.	156.0	16.0
8:0330	905.	1043.	0.	158.1	20.0
8:0430	910.	1042.	0.	152.1	13.6
8:0530	905.	1040.	0.	150.1	14.5
8:0630	905.	1040.	0.	150.1	17.7
8:0730	907.	1040.	0.	161.4	17.7
8:0830	903.	1040.	30.	156.4	22.4
8:0930	903.	1040.	30.	151.4	14.1
8:1030	903.	1040.	30.	162.6	16.0
8:1130	900.	1030.	30.	153.0	20.1
8:1230	895.	1040.	30.	150.7	26.3
8:1330	890.	1040.	30.	169.2	24.5
8:1430	888.	1010.	30.	161.0	27.2
8:1530	888.	1040.	30.	159.7	18.6
8:1630	893.	1040.	30.	150.9	20.7
8:1730	905.	1040.	30.	159.3	17.7
8:1830	890.	1040.	30.	162.2	23.6
8:1930	895.	1040.	30.	157.7	23.1
8:2030	900.	1040.	30.	160.5	18.1
8:2130	896.	1040.	0.	160.1	21.3

SHUT DOWN AT 8:2130 FOR 8 HOURS

DAY:HOUR	GASIFIER	REGEN.	RECYCLE	OIL	STONE
9:0630	890.	1040.	0.	160.1	10.4
9:0730	900.	1040.	0.	160.1	10.9
9:0830	920.	1040.	0.	160.5	7.3
9:0930	910.	1040.	30.	159.7	14.1
9:1030	910.	1040.	30.	159.7	21.0
9:1130	910.	1040.	30.	159.7	13.6
9:1230	912.	1040.	30.	159.7	13.6
9:1330	910.	1040.	0.	161.4	19.1
9:1430	910.	1045.	30.	159.3	22.2
9:1530	900.	1055.	30.	160.5	30.4

APPENDIX G, TABLE I.
RUN 9: TEMPERATURES AND FEED RATES   PAGE 5 OF 16

DAY.HOUR	TEMPERATURE, DEG. C. GASIF'ER	 REGEN.	 RECYCLE	FEED RATE KG/HR OIL	 STONE
9.1630	913.	1055.	30.	161.0	23.6
9.1730	915.	1055.	30.	156.0	15.4
9.1830	910.	1040.	30.	155.2	21.0
9.1930	905.	1050.	30.	155.2	25.6
9.2030	910.	1049.	30.	171.2	20.9

SHUT DOWN AT 9.2030 FOR 5 HOURS

DAY.HOUR	GASIF'ER	REGEN.	RECYCLE	OIL	STONE
10.0230	860.	920.	30.	158.9	6.4
10.0330	911.	1045.	30.	158.9	6.0
10.0430	911.	1043.	30.	158.9	8.6
10.0530	901.	1044.	30.	158.9	19.1
10.0630	902.	1044.	0.	159.3	27.7
10.0730	906.	1054.	0.	159.3	11.0
10.0830	904.	1050.	30.	158.9	24.9
10.0930	910.	1075.	30.	160.5	17.2
10.1030	903.	1080.	30.	156.0	17.7
10.1130	905.	1070.	30.	158.9	10.1
10.1230	905.	1060.	30.	158.1	17.7
10.1330	903.	1065.	30.	160.1	15.4
10.1430	903.	1061.	30.	157.3	17.7
10.1530	903.	1055.	30.	161.4	14.5
10.1630	900.	1050.	30.	156.0	15.4
10.1730	900.	1055.	30.	156.4	19.1
10.1830	900.	1055.	30.	163.4	16.3
10.1930	910.	1055.	30.	157.3	11.3
10.2030	902.	1055.	30.	158.5	10.0
10.2130	903.	1055.	30.	163.4	19.1
10.2230	905.	1056.	30.	158.1	14.1
10.2330	900.	1070.	30.	158.1	15.2
11.0030	892.	1075.	30.	158.1	24.9
11.0130	903.	1080.	30.	157.7	16.0
11.0230	904.	1066.	30.	158.5	14.5
11.0330	906.	1050.	30.	158.9	13.6
11.0430	907.	1040.	30.	158.5	15.9
11.0530	908.	1049.	30.	157.3	14.1
11.0630	907.	1050.	30.	158.5	10.4
11.0730	902.	1070.	30.	157.7	27.7
11.0830	911.	1060.	36.	157.7	14.5

APPENDIX G: TABLE I.
RUN 9: TEMPERATURES AND FEED RATES PAGE 6 OF 16

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
11:0930	988.	1062.	38.	159.3	21.0
11:1030	988.	1050.	38.	158.5	16.3
11:1130	915.	1053.	38.	158.5	19.1
11:1230	912.	1045.	38.	158.5	18.1
11:1330	912.	1040.	37.	159.3	13.6
11:1430	908.	1040.	38.	154.4	16.8
11:1530	903.	1041.	38.	158.5	16.3
11:1630	902.	1040.	38.	154.4	16.3
11:1730	899.	1040.	38.	154.0	22.0
11:1830	908.	1040.	38.	158.5	16.3
11:1930	905.	1049.	38.	158.9	17.7
11:2030	910.	1049.	38.	158.9	17.7
11:2130	910.	1041.	0.	152.7	17.0
11:2230	919.	1046.	32.	158.9	13.6
11:2330	906.	1051.	32.	158.5	18.0
12:0030	909.	1070.	31.	158.7	17.2
12:0130	900.	1054.	38.	141.2	21.0
12:0230	905.	1051.	38.	137.5	14.5
12:0330	899.	1053.	30.	140.0	15.4
12:0430	902.	1050.	38.	141.0	15.4
12:0530	910.	1060.	38.	141.6	14.1
12:0630	910.	1054.	38.	141.6	18.7
12:0730	915.	1060.	38.	141.0	18.4
12:0830	919.	1060.	38.	141.6	9.5
12:0930	915.	1060.	0.	141.6	10.9
12:1030	900.	1060.	0.	141.6	10.4
12:1130	900.	1070.	0.	140.0	5.9
12:1230	905.	1065.	0.	143.3	3.6
12:1330	903.	1062.	0.	143.3	7.3
12:1430	910.	1055.	0.	142.7	7.3
12:1530	916.	1060.	0.	146.6	7.0
12:1630	913.	1055.	0.	147.4	7.3
12:1730	910.	1070.	0.	147.0	7.3
12:1830	900.	1050.	0.	147.4	9.4
12:1930	900.	1050.	0.	147.0	4.5
12:2030	905.	1050.	0.	147.0	4.1
12:2130	905.	1050.	40.	149.0	1.0
12:2230	915.	1050.	40.	147.0	0.5
12:2330	915.	1050.	35.	146.6	7.3
13:0030	913.	1052.	23.	149.0	6.0

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                 APPENDIX G: TABLE 1.
   RUN 91  TEMPERATURES AND FEED RATES    PAGE  7 OF 16

DAY:HOUR      TEMPERATURE, DEG. C.        FEED RATE KG/HR
           GASIFIER   REGEN.  RECYCLE      OIL      STONE

13:0130      910.      1055.      83.      147.4      5.0
13:0230      910.      1043.      83.      147.0     10.4
13:0330      900.      1040.      83.      147.0      1.0
13:0430      917.      1060.      83.      149.4      6.0
13:0530      917.      1065.      83.      140.6      5.9
13:0630      900.      [illegible] 83.     147.0      5.4
13:0730      905.      1085.      83.      143.3      4.3
13:0830      900.      1075.      80.      147.4      5.0
13:0930      905.      1080.       0.      151.9      4.5
13:1030      905.      1080.       0.      147.4      3.6
13:1130      900.      1080.       0.      144.5      6.0

      SHUT DOWN AT 13:1130 FOR  13 HOURS

14:0130      905.      1055.       0.      147.4     17.2
14:0230      900.      1043.       0.      150.3     15.0
14:0330      900.      1050.       0.      137.5     24.0
14:0430      905.      1065.       0.      151.5     18.7
14:0530      910.      1065.       0.      151.9     10.4
14:0630      890.      1075.       0.      144.5     16.0
14:0730      895.      1080.       0.      146.6     10.1
14:0830      910.      1095.       0.      135.0     15.9
14:0930      915.      1095.       0.      138.7      9.1
14:1030      900.      1070.       0.      144.5      3.4
14:1130      930.      1100.       0.      144.5      5.9
14:1230      940.      1070.       0.      143.7      6.4
14:1330      945.      1070.       0.      141.6      7.7
14:1430      940.      1060.       0.      141.6      5.0
14:1530      930.      1075.       0.      143.7      5.0
14:1630      925.      1080.       0.      146.1      5.9
14:1730      900.      1070.       0.      149.4      8.6
14:1830      900.      1070.       0.      147.0      9.1
14:1930      900.      1070.      50.      144.5      9.1
14:2030      880.      1080.      50.      144.1     10.0
14:2130      870.      1075.      50.      146.6      8.0
14:2230      875.      1080.      50.      146.6      8.6
14:2330      873.      1070.      50.      140.0      8.0
15:0030      870.      1082.      60.      141.2      9.5
15:0130      863.      1070.      60.      147.4      9.5
```

APPENDIX G TABLE 1.

RUN 9: TEMPERATURES AND FEED RATES PAGE 8 OF 15

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
15:0230	863.	1078.	60.	142.8	9.1
15:0330	875.	1078.	60.	143.3	5.9
15:0430	878.	1078.	60.	145.3	5.8
15:0530	880.	1078.	66.	145.3	4.5
15:0630	885.	1078.	60.	142.0	4.5
15:0730	895.	1075.	60.	144.1	3.6
15:0830	888.	1078.	60.	141.8	7.3
15:0930	888.	1077.	56.	140.8	8.6
15:1030	895.	1078.	56.	139.6	9.1
15:1130	900.	1078.	54.	144.1	6.4
15:1230	908.	1075.	55.	142.4	5.9
15:1330	916.	1078.	45.	142.8	7.3
15:1430	916.	1078.	40.	142.4	5.9
15:1530	917.	1079.	35.	142.4	6.4
15:1630	914.	1081.	30.	142.4	6.8

SHUT DOWN AT 15:1630 FOR 14 HOURS

DAY:HOUR	GASIFIER	REGEN.	RECYCLE	OIL	STONE
16:0730	911.	1058.	50.	142.4	22.8
16:0830	900.	1060.	55.	140.8	17.8
16:0930	915.	1072.	53.	145.3	19.1
16:1030	901.	1040.	53.	142.0	21.8
16:1130	903.	1058.	53.	142.4	13.6
16:1230	901.	1058.	63.	142.8	6.4
16:1330	901.	1058.	63.	142.4	6.8
16:1430	903.	1057.	63.	142.4	5.4
16:1530	907.	1058.	63.	142.4	5.9
16:1630		MISSED DATA READING			
16:1730	916.	1056.	65.	138.3	4.2
16:1830	908.	1060.	63.	143.3	27.7
16:1930	900.	1061.	63.	106.8	7.3
16:2030	899.	1061.	63.	126.8	5.4
16:2130	899.	1060.	61.	127.6	5.4
16:2230	893.	1061.	60.	125.1	4.1
16:2330	903.	1060.	62.	125.6	4.5
17:0030		MISSED DATA READING			
17:0130		MISSED DATA READING			
17:0230	912.	1060.	61.	122.7	6.8
17:0330	906.	1060.	61.	164.7	6.4

APPENDIX D.1 TABLE 1.
RUN 9: TEMPERATURES AND FEED RATES PAGE 9 OF 16

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
17:0530	900.	1050.	61.	160.6	6.4
17:0630	899.	1050.	60.	165.5	6.4
17:0730	895.	1055.	60.	166.7	5.4
17:0830	901.	1055.	60.	163.0	5.4
17:0930	894.	1056.	60.	160.1	6.0
17:1030	900.	1056.	60.	169.0	7.0
17:1130	905.	1059.	60.	150.0	7.7
17:1230	900.	1059.	60.	166.7	7.3
17:1330	910.	1056.	59.	164.3	5.4
17:1430	899.	1055.	59.	164.7	5.9
17:1530	913.	1056.	61.	164.7	5.0
17:1630	910.	1056.	61.	164.7	4.1
17:1730	886.	1056.	61.	165.5	50.3
17:1830	903.	1055.	60.	189.0	9.1
17:1930	914.	1065.	59.	190.0	13.0
17:2030	914.	1060.	57.	193.1	7.3
17:2130	951.	1070.	42.	193.1	9.5
17:2230	943.	1070.	40.	195.1	9.1
17:2330	941.	1070.	40.	195.1	9.1
18:0030	941.	1070.	40.	195.1	9.5
18:0130	940.	1070.	40.	186.5	7.3
18:0230	941.	1065.	40.	193.9	7.3
18:0330	930.	1069.	40.	188.5	10.4
18:0430	955.	1069.	40.	195.5	9.1
18:0530	940.	1069.	40.	194.3	8.9
18:0630	945.	1070.	40.	194.3	7.7
18:0730	950.	1070.	40.	188.1	8.0
18:0830	960.	1075.	40.	193.5	7.7
18:0930	955.	1080.	40.	179.9	5.9
18:1030	955.	1075.	40.	189.0	6.4
18:1130	950.	1075.	40.	188.3	8.0
18:1230	950.	1075.	40.	178.4	8.0
18:1330	945.	1070.	40.	175.7	6.4
18:1430	953.	1070.	40.	170.7	5.0
18:1530	960.	1080.	44.	158.5	5.9
18:1630	960.	1090.	40.	158.5	5.4
18:1730	960.	1100.	40.	159.3	6.4
18:1830	960.	1097.	40.	157.7	8.0
18:1930	965.	1085.	40.	155.0	9.5
18:2030	900.	1080.	40.	131.7	10.0

APPENDIX G: TABLE 1:
RUN 9: TEMPERATURES AND FEED RATES PAGE 18 OF 18

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
18:2130	900.	1070.	40.	156.0	9.1
18:2230	900.	1070.	40.	146.7	5.9
18:2330	910.	1070.	40.	146.1	5.9
19:0030	900.	1070.	40.	147.0	8.8
19:0130	910.	1070.	40.	154.3	10.0
19:0230	940.	1080.	40.	147.4	9.1
19:0330	900.	1070.	40.	146.6	7.9
19:0430	900.	1070.	40.	144.1	5.8
19:0530	900.	1070.	40.	148.6	8.6
19:0630	900.	1070.	40.	146.6	4.1
19:0730	924.	1070.	40.	145.7	5.9
19:0830	910.	1070.	55.	145.1	6.8
19:0930	903.	1080.	55.	148.4	14.1
19:1030	900.	1065.	40.	148.0	17.7
19:1130	900.	1065.	40.	144.9	18.1
19:1230	915.	1065.	30.	148.0	25.9
19:1330	900.	1065.	30.	144.9	15.9
19:1430	MISSED DATA READING				
19:1530	910.	1070.	30.	146.1	26.3
19:1630	910.	1065.	0.	147.8	19.1
19:1730	910.	1060.	0.	148.9	26.8
19:1830	915.	1070.	0.	144.5	15.9
19:1930	900.	1053.	0.	146.1	18.1
19:2030	910.	1050.	0.	146.6	24.8
19:2130	903.	1070.	0.	148.6	13.8
19:2230	935.	1070.	0.	147.4	16.3
	STONE CHANGE				
19:2330	930.	1070.	0.	147.4	21.8
20:0030	900.	1075.	0.	147.8	21.3
20:0130	925.	1065.	0.	147.8	18.6
20:0230	925.	1060.	0.	147.0	15.8
20:0330	924.	1065.	0.	147.4	14.1
20:0430	900.	1065.	0.	147.8	10.9
20:0530	924.	1065.	0.	147.4	5.9
20:0630	930.	1065.	0.	147.4	10.9
20:0730	900.	1065.	0.	147.4	10.4
20:0830	935.	1060.	0.	146.6	10.9
	STONE CHANGE				
20:0930	933.	1080.	0.	146.5	9.1
20:1030	935.	1070.	0.	150.7	8.6

APPENDIX C: TABLE 1.

RUN 91 TEMPERATURES AND FEED RATES PAGE 11 OF 16

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
20.1130	948.	1085.	0.	145.7	7.7
20.1230	952.	1085.	0.	145.7	7.3
20.1330	948.	1080.	30.	145.7	7.3
20.1430	925.	1080.	0.	146.6	10.1
20.1530	936.	1080.	0.	146.6	17.7
20.1630	940.	1070.	3.	146.6	14.5
20.1730	935.	1070.	0.	146.6	14.1
20.1830	930.	1275.	0.	146.6	10.1
20.1930	958.	1075.	0.	147.0	11.3
20.2030	958.	1082.	0.	147.0	0.

SHUT DOWN AT 20.2030 FOR 35 HOURS

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
22.0830	919.	1039.	42.	114.5	51.3
22.0930	MISSED DATA READING				
22.1030	930.	1060.	53.	141.6	40.0
22.1130	921.	1060.	50.	130.3	22.0
22.1230	940.	1060.	42.	153.1	27.7
22.1330	922.	1042.	30.	142.0	30.6
22.1430	922.	1060.	34.	142.0	29.5
22.1530	925.	1069.	30.	154.0	20.4
22.1630	930.	1070.	40.	136.7	20.0
22.1730	924.	1075.	30.	131.3	20.0
22.1830	932.	1080.	30.	140.0	21.0
22.1930	932.	1081.	30.	133.0	10.6
22.2030	953.	1050.	30.	133.0	15.9
22.2130	949.	1061.	30.	110.0	14.0
22.2230	959.	1080.	36.	115.3	17.7
22.2330	964.	1089.	33.	113.6	15.9
23.0030	970.	1093.	30.	111.6	10.6
23.0130	974.	1112.	30.	109.9	17.0
23.0230	990.	1103.	30.	100.7	13.6
23.0330	993.	1106.	37.	106.6	11.9
23.0430	994.	1106.	39.	107.0	16.0
23.0530	997.	1108.	30.	107.0	13.6
23.0630	973.	1110.	44.	107.0	19.1
23.0730	970.	1096.	44.	107.0	14.1
23.0830	965.	1084.	43.	107.0	26.3
23.0930	970.	1105.	0.	110.3	20.5

APPENDIX D, TABLE 1:
RUN 9: TEMPERATURES AND FEED RATES PAGE 12 OF 16

DAY:HOUR	TEMPERATURE, DEG. C.: GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
03:1032	950.	1115.	0.	119.0	23.0
03:1130	940.	1105.	0.	130.5	19.1
03:1230	935.	1125.	0.	134.6	20.4
03:1330	940.	1140.	0.	147.0	15.9
03:1430	940.	1120.	0.	150.3	15.9
03:1530	920.	1130.	0.	150.7	17.2
03:1630	925.	1115.	30.	150.3	15.9
03:1730	930.	1100.	30.	149.4	15.6
03:1830	945.	1125.	30.	149.4	15.0
03:1930	950.	1130.	30.	149.4	15.0
03:2030	910.	1110.	30.	140.4	16.3
03:2130	900.	1100.	30.	144.1	15.0
03:2230	[illegible]	1115.	30.	140.2	10.2
03:2330	931.	1115.	30.	147.0	13.6
04:0030	947.	1116.	32.	141.6	14.1
04:0130	960.	1127.	30.	130.7	10.6
04:0230	970.	1150.	30.	130.7	7.3
04:0330	971.	1147.	30.	130.3	8.6
04:0430	960.	1162.	47.	120.0	6.0
04:0530	963.	1160.	40.	119.4	6.4
04:0630	967.	1170.	52.	114.0	6.4
04:0730	969.	1182.	52.	114.2	5.0
04:0830	960.	1185.	53.	114.2	6.4
04:0930	955.	1045.	50.	113.6	10.3
04:1030	959.	1060.	44.	122.2	25.4
04:1130	955.	1050.	40.	123.5	26.3
04:1230	950.	1050.	35.	123.9	24.5
04:1330	945.	1075.	33.	123.5	22.0
04:1430	950.	1075.	33.	123.5	21.0
04:1530	945.	1075.	33.	123.5	21.0
04:1630	944.	1070.	33.	123.5	19.5
04:1730	942.	1070.	30.	123.5	18.6
04:1830	947.	1075.	30.	123.5	19.7
04:1930	945.	1080.	34.	123.5	14.1
04:2030	940.	1095.	30.	125.5	17.2
04:2130	940.	1100.	30.	122.7	15.4
04:2230	940.	1110.	30.	124.7	14.5
04:2330	943.	1080.	30.	123.1	10.1
05:0030	940.	1090.	0.	122.3	20.4
05:0130	940.	1085.	0.	123.9	16.3

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                      APPENDIX 3.1  TABLE 1.
    RUN 91  TEMPERATURES AND FEED RATES    PAGE 13 OF 16

DAY:HOUR       TEMPERATURE, DEG. C.         FEED RATE KG/HR
           GASIFIER   REGEN.   RECYCLE       OIL        STONE

05:0230      930.      1000.       0.       103.9        20.9
05:0330      933.      1090.       5.       102.7        17.7
05:0430      945.      1105.       0.       127.6         0.0
05:0530      950.      1110.       0.       119.4         4.5
05:0630      950.      1103.      40.       104.0         4.1
05:0730      940.      1100.       0.       101.8         4.5
05:0830      970.      1095.       0.       101.9         5.0

        SHUT DOWN AT 05:0830 FOR   6 HOURS

05:1430      934.      1110.       0.       114.4         2.7
05:1530      940.      1130.       0.       114.4        10.0

        SHUT DOWN AT 05:1530 FOR   7 HOURS

05:2230      960.      1065.       0.       131.7         4.5
05:2330      965.      1100.       0.       130.1        10.4
06:0030      965.      1130.       0.       135.1         9.5
06:0130      925.      1135.       0.       130.3        10.7
06:0230      940.      1135.      40.       127.6        11.0
06:0330      940.      1140.      40.       133.0        10.0
06:0430      943.      1145.      40.       134.7        10.4
06:0530      955.      1110.       0.       126.0         0.0
06:0630      945.      1095.       0.       135.0        13.0
06:0730      945.      1085.       0.       127.6        13.0
06:0830      940.      1087.       0.       130.9         4.1

        SHUT DOWN AT 06:0830 FOR  14 HOURS

06:2230      870.       970.       0.       129.3        51.7
06:2330      879.      1000.       0.       130.1        50.3
07:0030      885.      1030.       0.       130.1        47.0
07:0130      900.      1025.       0.       130.1        23.1
07:0230      900.      1035.       0.       130.6        34.5
07:0330      905.      1030.       0.       131.3        30.7
07:0430      900.      1035.       0.       130.9        20.0
07:0530      915.      1040.       0.       128.5        24.0
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APPENDIX C , TABLE 1
RUN 9: TEMPERATURES AND FEED RATES PAGE 14 OF 16

DAY:HOUR	TEMPERATURE, DEG. C.:			FEED RATE KG/HR	
	GASIFIER	REGEN.	RECYCLE	OIL	STONE
07:0630	920.	1030.	0.	127.6	10.6
07:0730	940.	1035.	0.	140.0	9.8
07:0830	953.	1055.	30.	130.9	7.7
07:0930	945.	1040.	30.	121.0	7.7
07:1030	941.	1040.	30.	136.7	9.1
07:1130	950.	1044.	31.	130.5	10.4
07:1230	950.	1050.	31.	136.5	10.8
07:1330	956.	1050.	31.	130.9	7.5
07:1430	952.	1040.	31.	130.5	6.0
07:1530	950.	1045.	31.	130.1	10.5
07:1630	954.	1040.	31.	130.5	11.5
07:1730	950.	1044.	31.	130.1	9.6
07:1830	956.	1044.	31.	130.6	7.5
07:1930	950.	1047.	31.	130.0	6.0
07:2030	940.	1050.	31.	130.1	11.0
07:2130	940.	1050.	31.	130.7	14.1
07:2230	950.	1050.	31.	136.1	14.9
07:2330	956.	1040.	31.	135.0	9.1
08:0030	950.	1040.	31.	131.0	10.4
08:0130	946.	1045.	31.	130.0	10.7
08:0230	938.	1040.	31.	130.7	17.7
08:0330	940.	1040.	31.	130.1	14.5
08:0430	930.	1040.	31.	133.4	15.9
08:0530	935.	1045.	31.	137.6	10.1
08:0630	940.	1040.	31.	135.0	11.0
08:0730	930.	1040.	31.	137.6	10.0
08:0830	940.	1041.	37.	133.9	17.7
08:0930	936.	1039.	36.	130.1	15.0
08:1030	938.	1040.	35.	130.1	10.7
08:1130	939.	1040.	34.	130.1	10.0
08:1230	930.	1030.	34.	130.1	10.7
08:1330	944.	1040.	35.	134.6	10.6
08:1430	950.	1040.	34.	134.6	11.5
08:1530	950.	1045.	34.	140.0	10.1
08:1630	934.	1056.	34.	147.4	10.0
08:1730	950.	1055.	33.	147.0	11.0
08:1830	950.	1054.	33.	148.2	7.5
08:1930	945.	1050.	33.	148.2	0.
08:2030	944.	1055.	33.	148.0	0.
08:2130	950.	1050.	33.	149.0	0.

APPENDIX C: TABLE 1.

RUN 9: TEMPERATURES AND FEED RATES PAGE 15 OF 16

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
28.2230	945.	1050.	33.	145.7	4.5

SHUT DOWN AT 28.2230 FOR 24 HOURS

DAY.HOUR	TEMPERATURE, DEG. C. GASIFIER	REGEN.	RECYCLE	FEED RATE KG/HR OIL	STONE
29.2330	951.	990.	37.	161.8	0.
30.0030	955.	1000.	57.	160.8	19.5
30.0130	971.	1045.	40.	161.4	16.8
30.0230	MISSED DATA READING				
30.0330	MISSED DATA READING				
30.0430	945.	1045.	60.	170.5	8.6
30.0530	940.	1055.	60.	166.7	18.6
30.0630	918.	1040.	50.	128.8	20.1
30.0730	985.	1030.	47.	145.3	24.8
30.0830	990.	1025.	40.	135.5	24.5
30.0930	980.	1015.	40.	134.6	21.8
30.1030	935.	1035.	38.	138.5	9.1
30.1130	930.	1030.	35.	137.1	9.1
30.1230	940.	1035.	40.	131.3	11.3
30.1330	945.	1035.	35.	133.4	11.8
30.1430	940.	1035.	35.	131.3	9.5
30.1530	953.	1035.	35.	132.6	7.3
30.1630	950.	1030.	0.	135.8	7.3
30.1730	963.	1030.	0.	131.7	7.7
30.1830	975.	1045.	0.	134.2	8.8
30.1930	980.	1045.	0.	129.7	8.8
30.2030	975.	1045.	0.	131.8	5.9
30.2130	970.	1050.	0.	131.7	1.8
30.2230	1000.	1060.	40.	147.8	8.9
30.2330	955.	1075.	40.	140.6	1.8
31.0030	935.	1055.	40.	163.4	3.6
31.0130	985.	1060.	40.	163.4	20.8
31.0230	990.	1055.	40.	163.4	13.6
31.0330	930.	1055.	38.	167.5	18.9
31.0430	918.	1050.	38.	170.0	5.9
31.0530	905.	1060.	38.	158.3	4.5
31.0630	911.	1065.	38.	141.6	15.9
31.0730	900.	1065.	38.	141.6	18.1
31.0830	920.	1065.	38.	139.6	18.4
31.0930	920.	1068.	38.	140.8	9.5

APPENDIX C, TABLE 1.
RUN 9: TEMPERATURES AND FEED RATES   PAGE 16 OF 16

DAY:HOUR	TEMPERATURE, DEG. C. GASIFIER	 REGEN.	 RECYCLE	FEED RATE KG/HR OIL	 STONE
21:1030	915.	1065.	30.	129.7	12.2
21:1130	940.	1065.	30.	134.0	10.0
21:1230	960.	1060.	30.	136.3	2.3
21:1330	955.	1050.	30.	140.0	0.
21:1430	935.	1065.	30.	132.1	0.
21:1530	975.	1065.	30.	141.2	1.4
21:1630	945.	1065.	40.	144.9	63.0
21:1730	980.	1065.	50.	146.1	43.5
21:1830	975.	1065.	50.	150.7	38.0
21:1930	965.	1055.	0.	149.0	36.1
STONE CHANGE					
21:2030	945.	1055.	0.	135.4	40.5
21:2130	945.	1055.	0.	147.4	38.0
21:2230	925.	1055.	0.	147.0	18.1
21:2330	910.	1055.	0.	148.6	19.5
22:0030	940.	1055.	0.	149.6	9.3
22:0130	935.	1060.	0.	144.5	5.0
22:0230	925.	1065.	0.	145.7	11.0
22:0330	985.	1060.	0.	146.6	27.7
22:0430	940.	1065.	0.	146.1	5.0
22:0530	935.	1065.	0.	146.7	20.4
22:0630	925.	1065.	0.	146.1	10.0
22:0730	940.	1065.	0.	136.3	10.0
22:0830	945.	1065.	0.	129.7	5.4

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                    APPENDIX C, TABLE 11.
                  RUN 07 GAS FLOW RATES      PAGE  1 OF 16

                      G A S   R A T E S   M3/HR        REGEN.
DAY.HOUR        OXIDIZER       PILOT     REGENERATOR   VELOCITY
               AIR  FLUE GAS  PROPANE    AIR  NITROGEN   M/SEC

 1.1930        316.      30.      3.8      20.5     2.5      1.38
 1.2030        301.      22.      3.8      24.1     3.5      1.16
 1.2130        301.      19.      3.8      24.1     3.8      1.21

     SHUT DOWN AT  1.2130 FOR   4 HOURS

 2.0230        357.      25.      2.9      27.4     3.0      1.37
 2.0330        377.      34.      2.7      27.4     3.0      1.38
 2.0430        347.      66.      2.9      21.1     3.0      1.08
 2.0530        348.      62.      2.9      29.9     3.3      1.44
 2.0630        340.      67.      3.3      23.8     3.3      1.00
 2.0730        342.      66.      3.2      24.2     3.1      1.10
 2.0830        342.      65.      3.2      25.4     3.1      1.23
 2.0930        321.      47.      3.8      24.8     2.3      1.18
 2.1030        330.      50.      3.8      24.5     2.1      1.22
 2.1130        330.      50.      3.8      24.4     2.0      1.21
 2.1230        357.      24.      3.8      26.7     2.1      1.23
 2.1330        355.      20.      3.8      27.8     2.0      1.34
 2.1430        316.       0.      3.8      31.4     2.4      1.55
 2.1530        353.       0.      3.8      28.3     2.2      1.38
 2.1630        353.       0.      3.8      28.8     2.7      1.42
 2.1730        379.       0.      3.8      31.5     2.4      1.52
 2.1830        387.       0.      3.8      33.5     2.0      1.64
 2.1930        387.       0.      2.9      34.7     2.7      1.69
 2.2030        387.       0.      2.9      38.0     2.6      1.80
 2.2130        404.       0.      3.8      37.2     2.9      1.82
 2.2230        387.       0.      3.8      38.4     2.2      1.84
 2.2330        387.       0.      3.8      37.7     2.6      1.82

     SHUT DOWN AT  2.2330 FOR  28 HOURS

 4.0430        388.      66.      4.6      28.9     2.5      1.33
 4.0530        325.      66.      4.6      27.8     2.3      1.33
 4.0630        325.      66.      4.6      30.9     2.6      1.54
 4.0730        394.      54.      4.6      29.9     2.0      1.50
 4.0830        377.      51.      4.6      30.8     2.2      1.47
 4.0930        394.      44.      4.6      28.4     1.5      1.37
 4.1030                MISSED DATA READING
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APPENDIX 6: TABLE 11.
RUN 91 GAS FLOW RATES   PAGE 2 OF 16

DAY.HOUR	G A S R A T E S M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
4.1230	412.	88.	4.6	26.7	4.2	1.39
4.1330	395.	126.	4.6	26.6	3.6	1.40
4.1430	395.	126.	4.6	26.0	3.8	1.05
4.1530	394.	108.	4.6	26.5	3.1	1.05
4.1630	394.	108.	4.6	26.3	3.0	1.47
4.1730	388.	108.	4.6	26.6	3.1	1.33
4.1830	412.	120.	4.6	26.6	3.2	1.40
4.1930	394.	120.	4.6	26.6	3.6	1.43
4.2030	394.	117.	4.6	24.6	3.6	1.23
4.2130	412.	107.	4.6	24.9	3.2	1.23
4.2230	420.	108.	4.6	27.2	3.2	1.25
4.2330	429.	108.	4.6	26.5	3.6	1.19
5.0030	440.	97.	4.6	26.6	3.4	1.26
5.0130	440.	97.	4.6	26.6	3.3	1.34
5.0230	445.	91.	4.6	26.0	3.3	1.32
5.0330	440.	97.	4.6	26.4	3.3	1.36
5.0430	440.	97.	4.6	26.9	3.4	1.29
5.0530	440.	97.	4.6	26.7	3.1	1.41
5.0630	420.	77.	4.6	23.0	3.1	1.19
5.0730	420.	77.	4.6	23.0	3.2	1.20
5.0830	420.	77.	4.6	24.1	3.1	1.28
5.0930	420.	77.	4.6	24.6	3.1	1.18
5.1030	420.	97.	4.6	23.6	3.1	1.21
5.1130	420.	97.	4.6	24.3	3.3	1.39
5.1230	420.	97.	4.6	27.9	3.4	1.44
5.1330	440.	97.	4.6	26.7	3.3	1.44
5.1430	440.	130.	4.6	26.0	6.1	1.44
5.1530	420.	130.	4.6	29.2	6.9	1.44
5.1630	420.	130.	4.6	26.9	6.2	1.00
5.1730	430.	130.	4.6	27.6	3.1	1.30
5.1830	430.	130.	4.6	27.7	3.3	1.40
5.1930	430.	130.	4.6	27.6	3.6	1.38
5.2030	430.	130.	4.6	26.4	3.4	1.38
5.2130	420.	117.	4.6	24.5	3.1	1.35
5.2230	445.	116.	4.6	27.1	3.1	1.30
5.2330	446.	116.	4.6	26.1	3.2	1.40
6.0030	448.	117.	4.6	26.9	3.2	1.40
6.0130	448.	117.	4.6	26.6	3.2	1.40
6.0230	447.	117.	4.6	26.4	3.3	1.40
6.0330	446.	117.	4.8	26.7	3.2	1.40

APPENDIX G, TABLE 11.
RUN 07 GAS FLOW RATES PAGE 3 OF 10

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
6.0430	447.	107.	4.8	29.7	3.2	1.49
6.0530	447.	107.	4.8	30.0	3.3	1.54
6.0630	445.	107.	4.8	31.7	3.4	1.58
6.0730	447.	107.	4.8	30.7	3.3	1.54
6.0830	446.	107.	4.8	31.3	3.3	1.56
6.0930	444.	107.	4.8	31.0	3.4	1.55
6.1030	444.	107.	4.8	31.5	3.5	1.58
6.1130	446.	107.	4.8	33.0	4.0	1.70
6.1230	446.	107.	4.8	33.6	3.8	1.71
6.1330	446.	107.	4.8	34.9	4.3	1.77
6.1430	444.	107.	4.8	37.0	5.1	1.91
6.1530	412.	127.	4.8	32.0	3.0	1.61
6.1630	412.	117.	4.8	33.3	2.0	1.60
6.1730	412.	117.	4.8	30.9	1.5	1.57
6.1830	412.	117.	4.8	23.9	2.0	1.04
6.1930	377.	80.	4.8	22.0	2.0	0.99
6.2030	377.	116.	4.8	24.8	7.5	1.42

SHUT DOWN AT 6.2030 FOR 4 HOURS

DAY.HOUR	GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
7.0130	378.	0.	4.8	25.5	3.3	1.32
7.0230	402.	0.	4.8	34.4	3.1	1.72
7.0330	404.	0.	4.8	35.8	3.8	1.76
7.0430	481.	0.	4.8	37.7	4.4	1.91
7.0530	463.	0.	4.8	36.2	3.3	1.79
7.0630	445.	0.	4.8	35.8	3.0	1.76
7.0730	428.	0.	4.8	36.1	2.9	1.77
7.0830	445.	0.	4.8	35.3	2.8	1.73
7.0930	445.	0.	4.8	34.3	2.9	1.68
7.1030	411.	0.	4.8	31.1	2.6	1.52
7.1130	428.	0.	4.8	31.2	2.8	1.53
7.1230	428.	0.	4.8	32.2	2.9	1.50
7.1330	428.	0.	4.8	31.6	2.1	1.52
7.1430	428.	0.	4.8	31.7	1.8	1.51
7.1530	428.	0.	4.8	30.8	2.3	1.49
7.1630	454.	0.	4.8	29.2	2.6	1.40
7.1730	428.	0.	4.8	26.7	1.9	1.24
7.1830	445.	0.	4.8	24.5	2.2	1.20
7.1930	445.	0.	4.8	22.4	2.2	1.11

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                   APPENDIX C, TABLE 11.
                   RUN 87  GAS FLOW RATES      PAGE  4 OF 16

                          G A S    R A T E S    M3/HR          REGEN.
DAY.HOUR        GASIFIER          PILOT       REGENERATOR    VELOCITY
               AIR   FLUE GAS    PROPANE     AIR   NITROGEN    M/SEC

 7.2030        447.     0.         4.9       21.4     2.4       1.88
 7.2130        464.     0.         4.6       42.7     3.4       2.08
 7.2230        464.     0.         4.6       42.1     3.3       2.05
 7.2330        447.     0.         4.6       39.7     3.4       1.94
 8.0030        447.     0.         4.6       40.3     3.0       1.97
 8.0130        447.     0.         4.6       37.1     3.1       1.81
 8.0230        447.     0.         4.6       37.1     3.2       1.82
 8.0330        447.     0.         4.6       37.0     3.2       1.81
 8.0430        447.     0.         4.6       37.5     3.1       1.83
 8.0530        447.     0.         4.6       36.4     3.1       1.78
 8.0630        447.     0.         4.6       36.9     3.1       1.80
 8.0730        464.     0.         4.6       46.7     4.0       2.31
 8.0830        464.     0.         4.6       40.0     3.2       1.94
 8.0930        464.     0.         4.6       41.3     3.6       2.02
 8.1030        464.     0.         4.6       39.1     3.2       1.90
 8.1130        464.     0.         4.6       39.9     3.3       1.93
 8.1230        464.     0.         4.6       40.4     3.0       1.95
 8.1330        464.     0.         4.6       40.4     3.6       1.97
 8.1430        464.     0.         4.6       40.6     3.1       1.96
 8.1530        430.     0.         4.6       40.0     3.2       1.97
 8.1630        430.     0.         4.6       40.2     3.2       1.96
 8.1730        464.     0.         4.6       39.6     3.5       1.94
 8.1830        447.     0.         4.6       41.0     3.1       1.98
 8.1930        464.     0.         4.6       39.6     2.9       1.91
 8.2030        464.     0.         4.6       40.9     3.4       1.98
 8.2130        447.     0.         4.6       40.7     3.1       1.96

     SHUT DOWN AT  8.2130 FOR   8 HOURS

 9.0630        443.     0.         4.6       42.4     3.3       2.08
 9.0730        426.     0.         4.6       43.0     3.5       2.15
 9.0830        400.     0.         4.6       34.1     3.2       1.69
 9.0930        400.     0.         4.6       34.1     3.2       1.69
 9.1030        400.     0.         4.6       30.3     2.8       1.88
 9.1130        400.     0.         4.6       37.2     3.2       1.83
 9.1230        400.     0.         4.6       33.6     3.0       1.66
 9.1330        400.     0.         4.6       35.2     2.9       1.73
 9.1430        400.     0.         4.6       36.3     3.3       1.80
 9.1530        400.     0.         4.6       36.3     3.1       1.80
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                    APPENDIX G: TABLE II.
                 RUN 9: GAS FLOW RATES     PAGE  5 OF 16

                    G A S   R A T E S   M3/HR          REGEN.
DAY.HOUR        GASIFIER        PILOT      REGENERATOR  VELOCITY
              AIR  FLUE GAS   PROPANE    AIR  NITROGEN    M/SEC

  9.1630      400.       0.       4.6       37.6     4.0       1.87
  9.1730      400.       0.       4.6       36.8     2.9       1.82
  9.1830      400.       0.       4.6       34.8     3.2       1.69
  9.1930      401.       0.       4.6       36.6     2.5       1.69
  9.2030      401.       0.       4.6       37.4     3.4       1.86

        SHUT DOWN AT  9.2030 FOR   5 HOURS

 10.0230      440.       0.       4.6       40.4     3.5       1.92
 10.0330      420.       0.       4.6       37.7     3.7       1.89
 10.0430      440.       0.       4.6       37.5     4.0       1.89
 10.0530      463.       0.       4.6       37.1     4.1       1.87
 10.0630      445.       0.       4.6       36.3     3.7       1.82
 10.0730      445.       0.       4.6       36.9     6.2       1.98
 10.0830      445.       0.       4.6       34.7     6.7       1.89
  10.0930      462.       0.       4.6       27.1     7.2       1.59
 10.1030      462.       0.       4.6       23.1     6.7       1.39
 10.1130      446.       0.       4.6       39.0     6.8       2.12
 10.1230      445.       0.       4.6       36.6     6.8       1.95
 10.1330      445.       0.       4.6       39.1     7.0       2.13
 10.1430      445.       0.       4.6       38.4     7.9       2.04
 10.1530      445.       0.       4.6       35.2     5.6       1.86
 10.1630      445.       0.       4.7       37.7     7.2       2.04
 10.1730      444.       0.       4.7       37.7     6.7       2.03
 10.1830      444.       0.       4.7       40.3     7.3       2.18
 10.1930      443.       0.       4.7       39.9     6.9       2.14
 10.2030      427.       0.       4.7       39.1     6.9       2.11
 10.2130      428.       0.       4.7       39.6     6.0       2.12
 10.2230      428.       0.       4.7       39.8     7.0       1.61
 10.2330      440.       0.       4.7       42.1     7.3       2.29
 11.0030      446.       0.       4.7       43.6     6.8       2.31
 11.0130      429.       0.       4.7       42.4     6.8       2.26
 11.0230      446.       0.       4.7       35.4     4.7       1.85
 11.0330      446.       0.       4.7       34.4     5.0       1.82
 11.0430      633.       0.       4.7       34.6     5.7       1.83
 11.0530      428.       0.       4.7       34.1     6.4       1.85
 11.0630      428.       0.       4.7       35.8     7.6       1.98
 11.0730      428.       0.       4.7       37.4     7.6       2.00
 11.0830      446.       0.       4.7       37.5     6.8       2.05
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APPENDIX G: TABLE II.

RUN 9: GAS FLOW RATES PAGE 6 OF 16

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
11.0930	445.	0.	4.7	37.6	6.0	2.03
11.1030	445.	0.	4.7	40.0	6.2	2.11
11.1130	441.	0.	4.7	37.7	5.8	1.98
11.1230	442.	0.	4.7	34.3	3.5	1.71
11.1330	442.	0.	4.7	30.3	3.8	1.66
11.1430	443.	0.	4.7	29.0	4.0	1.49
11.1530	443.	0.	4.7	35.0	3.4	1.74
11.1630	407.	0.	4.7	35.0	3.7	1.78
11.1730	407.	0.	4.7	35.1	3.5	1.66
11.1830	407.	0.	4.7	34.3	2.9	1.68
11.1930	407.	0.	4.7	33.1	4.2	1.69
11.2030	441.	0.	4.7	34.1	3.6	1.71
11.2130	441.	0.	4.7	32.2	3.2	1.60
11.2230	458.	0.	4.7	33.1	3.7	1.67
11.2330	463.	0.	4.7	33.4	3.4	1.67
12.0030	394.	0.	4.7	32.8	3.4	1.72
12.0130	394.	0.	4.7	38.8	4.2	1.61
12.0230	394.	0.	4.7	29.4	4.1	1.53
12.0330	377.	0.	4.7	29.5	4.1	1.54
12.0430	377.	0.	4.7	29.0	4.4	1.50
12.0530	394.	0.	4.7	30.3	4.3	1.60
12.0630	394.	0.	4.7	30.0	4.2	1.57
12.0730	394.	0.	4.7	30.0	3.7	1.55
12.0830	412.	0.	4.7	30.0	3.9	1.56
12.0930	412.	0.	4.7	30.1	3.8	1.56
12.1030	412.	0.	4.6	30.0	3.7	1.55
12.1130	412.	0.	4.6	29.8	3.6	1.55
12.1230	412.	0.	4.7	34.1	3.4	1.73
12.1330	426.	0.	4.7	30.0	3.1	1.57
12.1430	407.	0.	4.7	37.7	3.3	1.87
12.1530	407.	0.	4.7	36.8	3.4	1.78
12.1630	407.	0.	4.7	31.9	3.1	1.66
12.1730	407.	0.	4.7	31.4	3.1	1.57
12.1830	407.	0.	4.7	31.7	3.0	1.58
12.1930	406.	0.	4.7	31.3	3.0	1.56
12.2030	406.	0.	4.7	31.4	2.9	1.56
12.2130	406.	0.	4.7	31.3	3.0	1.56
12.2230	406.	0.	3.1	31.7	3.0	1.58
12.2330	406.	0.	4.7	31.4	3.4	1.58
13.0030	406.	0.	4.7	31.0	2.8	1.58

APPENDIX 9, TABLE 11.
RUN 91 GAS FLOW RATES PAGE 7 OF 16

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
13.0130	406.	0.	4.7	31.7	3.0	1.58
13.0230	406.	0.	4.7	31.0	3.0	1.54
13.0330	406.	0.	4.7	31.2	2.9	1.54
13.0430	400.	0.	4.7	30.6	2.9	1.53
13.0530	406.	0.	4.7	30.7	2.9	1.54
13.0630	406.	0.	4.7	29.9	3.3	1.54
13.0730	423.	0.	4.7	30.1	4.1	1.58
13.0830	414.	0.	4.7	27.5	4.3	1.46
13.0930	397.	0.	4.6	30.1	3.0	1.56
13.1030	396.	0.	4.6	34.6	2.9	1.73
13.1130	396.	0.	4.6	38.6	2.0	1.61

UNIT DOWN AT 13.1130 FOR 13 HOURS

DAY.HOUR	GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
14.0130	403.	0.	4.8	32.8	2.0	1.02
14.0230	403.	0.	4.8	30.5	2.2	1.49
14.0330	403.	0.	4.8	26.8	1.0	1.31
14.0430	403.	0.	4.8	24.5	2.4	1.35
14.0530	403.	0.	4.8	23.8	1.7	1.18
14.0630	398.	0.	4.8	21.2	1.9	1.00
14.0730	398.	0.	4.8	21.8	1.9	1.11
14.0830	403.	0.	4.8	19.7	1.8	1.02
14.0930	406.	0.	4.8	30.1	1.3	1.01
14.1030	406.	0.	4.8	30.6	2.0	1.02
14.1130	407.	0.	4.8	30.6	2.0	1.06
14.1230	421.	0.	4.8	41.3	2.7	1.84
14.1330	441.	0.	4.8	37.6	2.7	1.87
14.1430	424.	0.	4.8	37.8	2.5	1.86
14.1530	424.	0.	4.8	38.6	1.4	1.93
14.1630	424.	0.	4.8	34.6	3.0	1.70
14.1730	424.	0.	4.8	31.6	2.9	1.60
14.1830	427.	0.	4.8	31.3	2.8	1.59
14.1930	398.	100.	4.8	30.7	2.8	1.56
14.2030	398.	73.	4.8	30.8	2.8	1.56
14.2130	398.	73.	4.8	30.8	2.8	1.56
14.2230	398.	73.	4.8	31.4	2.8	1.59
14.2330	398.	72.	4.8	32.5	2.7	1.63
15.0030	424.	82.	4.8	30.3	3.0	1.64
15.0130	398.	66.	4.8	30.3	3.4	1.61

APPENDIX 9, TABLE 11.
RUN 9: GAS FLOW RATES PAGE 8 OF 10

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR		PILOT PROPANE	REGENERATOR AIR	REGENERATOR NITROGEN	REGEN. VELOCITY M/SEC
	AIR	FLUE GAS				
15.0230	407.	56.	4.8	29.9	2.6	1.51
15.0330	424.	61.	4.8	29.5	2.8	1.49
15.0430	424.	84.	4.8	33.4	3.8	1.68
15.0530	424.	84.	4.8	26.5	2.5	1.35
15.0630	424.	88.	4.8	29.6	2.7	1.50
15.0730	424.	16.	4.8	29.4	2.8	1.49
15.0830	390.	166.	4.8	28.4	2.8	1.44
15.0930	408.	73.	4.8	33.2	3.0	1.66
15.1030	408.	73.	4.8	29.6	2.7	1.49
15.1130	425.	67.	4.8	32.2	3.0	1.61
15.1230	425.	72.	4.8	30.8	2.7	1.53
15.1330	442.	0.	4.8	30.7	2.7	1.53
15.1430	425.	0.	4.8	31.9	3.2	1.57
15.1530	442.	0.	4.8	31.1	2.9	1.55
15.1630	425.	0.	4.8	35.1	3.0	1.76

SHUT DOWN AT 15.1630 FOR 14 HOURS

DAY.HOUR	GASIFIER AIR	GASIFIER FLUE GAS	PILOT PROPANE	REGENERATOR AIR	REGENERATOR NITROGEN	REGEN. VELOCITY M/SEC
16.0730	428.	51.	4.8	34.2	2.9	1.78
16.0830	428.	42.	4.8	27.3	7.4	1.68
16.0930	445.	43.	4.8	28.1	6.9	1.62
16.1030	445.	72.	4.8	28.6	4.7	1.52
16.1130	452.	155.	4.8	35.9	3.3	1.77
16.1230	451.	155.	4.8	39.7	3.5	1.97
16.1330	451.	155.	4.8	39.4	3.6	1.97
16.1430	446.	155.	4.8	39.4	3.5	1.96
16.1530	446.	155.	4.8	39.7	3.6	1.98
16.1630	MISSED DATA READING					
16.1730	395.	17.	4.8	30.6	3.7	1.57
16.1830	412.	11.	4.8	35.4	3.5	1.80
16.1930	395.	10.	4.8	39.5	3.7	2.00
16.2030	394.	194.	4.8	38.9	3.6	1.97
16.2130	377.	184.	4.8	41.3	3.5	2.07
16.2230	377.	184.	4.8	39.7	3.6	2.01
16.2330	378.	184.	4.5	39.1	3.6	1.97
17.0030	MISSED DATA READING					
17.0130	MISSED DATA READING					
17.0330	445.	135.	4.8	33.4	3.5	1.69
17.0430	444.	136.	4.8	31.3	3.3	1.58

APPENDIX 9, TABLE 11.
RUN 91 GAS FLOW RATES PAGE 9 OF 16

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
17.0530	443.	136.	4.8	31.5	3.3	1.59
17.0630	444.	136.	4.8	33.4	3.6	1.69
17.0730	443.	136.	4.8	32.9	3.1	1.64
17.0830	444.	126.	4.8	31.3	3.2	1.57
17.0930	461.	126.	4.8	30.5	3.3	1.54
17.1030	464.	116.	4.8	29.4	4.1	1.52
17.1130	464.	126.	4.8	30.2	3.3	1.89
17.1230	464.	126.	4.8	39.7	3.5	1.97
17.1330	464.	126.	4.8	39.7	3.7	1.97
17.1430	464.	106.	4.8	40.0	3.4	1.98
17.1530	464.	116.	4.8	40.3	3.4	1.99
17.1630	481.	126.	4.8	40.1	3.5	1.98
17.1730	481.	94.	4.9	39.7	3.4	1.96
17.1830	446.	58.	4.9	38.4	3.7	1.91
17.1930	446.	56.	4.9	38.8	3.3	1.92
17.2030	463.	61.	4.8	42.9	3.3	2.18
17.2130	558.	0.	4.8	41.8	3.5	2.04
17.2230	515.	0.	4.8	33.3	2.9	1.66
17.2330	516.	0.	4.8	29.7	3.1	1.58
18.0030	516.	0.	4.8	31.6	3.8	1.58
18.0130	516.	0.	4.8	27.8	2.8	1.49
18.0230	515.	0.	4.8	28.8	3.5	1.47
18.0330	481.	0.	4.8	27.3	2.9	1.38
18.0430	481.	0.	4.8	27.7	3.6	1.40
18.0530	481.	0.	4.8	26.5	3.1	1.44
18.0630	498.	0.	4.8	31.7	3.2	1.59
18.0730	533.	0.	4.8	31.5	3.2	1.58
18.0830	515.	0.	4.8	31.8	3.3	1.68
18.0930	515.	0.	4.8	30.5	3.1	1.55
18.1030	532.	0.	4.8	30.6	3.4	1.56
18.1130	532.	0.	4.8	30.2	3.3	1.53
18.1230	498.	0.	4.8	28.0	3.1	1.46
18.1330	377.	53.	4.8	32.4	3.7	1.64
18.1430	426.	0.	4.8	31.2	3.5	1.58
18.1530	428.	0.	4.8	35.2	3.9	1.88
18.1630	411.	0.	4.8	41.6	4.1	2.13
18.1730	411.	0.	4.8	44.3	4.2	2.27
18.1830	359.	85.	4.8	44.7	3.9	2.27
18.1930	377.	67.	4.8	43.9	3.5	2.19
18.2030	384.	53.	4.8	41.1	3.8	2.03

APPENDIX C. TABLE II.
RUN 9: GAS FLOW RATES PAGE 10 OF 16

	G A S		R A T E S	M3/HR		REGEN.
DAY.HRMN	GASIFIER		PILOT	REGENERATOR		VELOCITY
	AIR	FLUE GAS	PROPANE	AIR	NITROGEN	M/SEC
18.2130	407.	95.	4.8	45.8	3.5	2.26
18.2230	407.	92.	4.8	27.3	2.9	1.39
18.2330	424.	64.	4.8	34.9	2.9	1.74
19.0030	389.	57.	4.8	33.9	3.0	1.69
19.0130	407.	16.	4.8	26.7	3.2	1.37
19.0230	407.	36.	4.8	34.0	3.0	1.71
19.0330	389.	78.	4.8	34.1	3.2	1.71
19.0430	389.	85.	4.8	30.4	3.1	1.53
19.0530	389.	81.	4.8	31.1	3.2	1.57
19.0630	389.	78.	4.8	31.3	3.2	1.58
19.0730	389.	83.	4.8	28.1	3.2	1.44
19.0830	389.	84.	4.8	28.2	3.1	1.43
19.0930	416.	77.	4.8	28.5	3.2	1.45
19.1030	427.	16.	4.8	27.4	3.1	1.39
19.1130	427.	16.	4.8	27.7	3.1	1.40
19.1230	427.	0.	4.8	26.6	3.0	1.35
19.1330	427.	0.	4.8	27.7	3.1	1.41
19.1430	MISSED DATA READING					
19.1530	427.	0.	4.8	37.4	3.0	1.85
19.1630	444.	0.	4.8	37.7	3.2	1.87
19.1730	444.	0.	4.8	37.5	3.1	1.85
19.1830	462.	0.	4.8	36.9	3.2	1.82
19.1930	444.	0.	4.8	36.3	3.3	1.79
19.2030	462.	0.	4.8	36.7	3.2	1.81
19.2130	444.	0.	4.8	35.6	3.3	1.76
19.2230	444.	0.	4.8	32.9	3.1	1.64
	STONE CHANGE					
19.2330	462.	0.	4.8	32.9	3.2	1.64
20.0030	444.	0.	4.8	32.6	3.3	1.64
20.0130	444.	0.	4.8	32.5	3.4	1.63
20.0230	444.	0.	4.8	32.4	3.4	1.62
20.0330	444.	0.	4.8	32.2	3.4	1.62
20.0430	444.	0.	4.8	32.3	3.3	1.62
20.0530	444.	0.	4.4	32.6	3.2	1.60
20.0630	444.	0.	4.8	31.8	3.2	1.59
20.0730	444.	0.	4.8	35.7	3.4	1.78
20.0830	444.	0.	4.8	35.6	3.2	1.76
	STONE CHANGE					
20.0930	444.	0.	4.8	35.6	3.2	1.76
20.1030	427.	0.	4.8	37.7	3.2	1.88

APPENDIX 9. TABLE 11.
RUN 9: GAS FLOW RATES PAGE 11 OF 16

DAY.HOUR	G A S R A T E S M3/HR GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
20.1130	427.	0.	4.8	39.7	3.7	2.00
20.1230	427.	0.	4.8	39.7	3.7	2.00
20.1330	444.	45.	4.8	39.7	3.7	2.00
20.1430	427.	0.	4.8	40.5	3.6	1.99
20.1530	427.	43.	4.8	40.5	3.6	2.01
20.1630	427.	0.	4.8	36.1	3.4	1.88
20.1730	427.	0.	4.8	41.2	4.0	2.06
20.1830	427.	0.	4.8	31.2	3.9	1.56
20.1930	427.	0.	4.8	35.0	3.3	1.74
20.2030	427.	0.	4.8	36.8	3.5	1.83

SHUT DOWN AT 20.2030 FOR 35 HOURS

DAY.HOUR	GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
22.0830	511.	53.	4.9	20.2	3.6	1.35
22.0930	MISSED DATA READING					
22.1030	510.	44.	4.9	35.1	3.7	1.78
22.1130	445.	37.	4.9	32.1	3.2	1.63
22.1230	464.	0.	4.9	32.5	3.3	1.69
22.1330	455.	0.	4.9	35.0	3.6	1.61
22.1430	446.	0.	4.9	31.0	3.3	1.66
22.1530	446.	0.	4.9	34.0	4.1	1.77
22.1630	440.	0.	4.9	31.0	4.4	1.67
22.1730	446.	0.	4.9	31.8	4.0	1.67
22.1830	417.	0.	4.9	30.0	5.2	1.63
22.1930	393.	0.	4.9	32.9	5.7	1.79
22.2030	392.	0.	4.9	28.4	5.5	1.56
22.2130	394.	0.	4.9	29.3	4.8	1.39
22.2230	392.	0.	4.9	27.1	5.6	1.53
22.2330	393.	0.	4.9	27.1	4.8	1.47
23.0030	410.	0.	4.9	28.8	4.8	1.37
23.0130	418.	0.	4.9	30.4	6.1	1.72
23.0230	418.	0.	4.9	28.1	6.3	1.61
23.0330	427.	0.	4.9	29.3	6.7	1.60
23.0430	426.	0.	4.9	27.9	6.6	1.56
23.0530	418.	0.	4.9	28.4	6.7	1.61
23.0630	375.	30.	4.9	27.4	6.4	1.63
23.0730	393.	30.	4.9	25.8	6.5	1.52
23.0830	409.	0.	4.9	24.2	4.8	1.37
23.0930	427.	0.	4.9	23.5	4.6	1.36

APPENDIX G. TABLE II.
RUN 9: GAS FLOW RATES   PAGE 12 OF 16

DAY.HOUR	G A S R A T E S M3/HR GASIFIER AIR	 FLUE GAS	 PILOT PROPANE	 REGENERATOR AIR	 NITROGEN	REGEN. VELOCITY M/SEC
23.1030	420.	0.	4.9	25.3	5.1	1.47
23.1130	420.	0.	4.9	25.7	4.7	1.40
23.1230	376.	0.	4.9	24.9	3.1	1.36
23.1330	410.	0.	4.9	27.5	3.3	1.51
23.1430	410.	0.	4.9	25.5	3.2	1.39
23.1530	410.	0.	4.9	29.8	3.4	1.58
23.1630	410.	0.	4.9	34.0	3.3	1.83
23.1730	411.	0.	4.9	34.4	2.8	1.88
23.1830	411.	0.	4.9	34.8	3.5	1.86
23.1930	411.	0.	4.9	36.1	3.4	1.92
23.2030	341.	0.	4.9	34.1	3.4	1.81
23.2130	341.	0.	4.9	25.9	2.4	1.37
23.2230	375.	0.	4.9	23.8	2.5	1.23
23.2330	410.	0.	4.9	21.6	2.4	1.15
24.0030	427.	0.	4.9	21.6	2.5	1.16
24.0130	443.	0.	4.9	25.7	2.7	1.37
24.0230	445.	0.	4.9	26.3	2.7	1.43
24.0330	409.	0.	4.9	29.1	2.4	1.50
24.0430	410.	33.	4.9	25.1	2.9	1.39
24.0530	393.	34.	4.9	23.9	3.0	1.34
24.0630	376.	26.	4.9	24.1	2.8	1.34
24.0730	376.	27.	4.9	24.1	2.7	1.30
24.0830	376.	33.	4.9	22.7	2.7	1.20
24.0930	375.	29.	4.9	19.1	3.6	1.03
24.1030	393.	0.	4.9	26.4	5.3	1.44
24.1130	410.	0.	4.9	30.1	5.1	1.61
24.1230	410.	0.	4.9	30.6	5.2	1.61
24.1330	410.	0.	4.9	29.4	5.9	1.60
24.1430	410.	0.	4.0	28.8	4.9	1.56
24.1530	410.	0.	4.9	28.6	4.9	1.56
24.1630	393.	0.	4.9	28.0	5.8	1.57
24.1730	393.	0.	4.9	28.7	4.0	1.55
24.1830	393.	0.	4.9	28.7	4.9	1.50
24.1930	375.	0.	4.9	28.9	4.9	1.58
24.2030	375.	0.	4.9	28.7	4.9	1.58
24.2130	375.	0.	4.9	27.9	4.8	1.55
24.2230	410.	0.	4.9	28.8	4.8	1.66
24.2330	410.	0.	4.9	28.5	3.9	1.51
25.0030	410.	0.	4.9	28.1	3.8	1.58
25.0130	410.	0.	4.9	28.3	3.9	1.60

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                        APPENDIX 9, TABLE 11.
                   RUN 9, GAS FLOW RATES    PAGE 13 OF 16

                    G A S   R A T E S   M3/HR          REGEN.
DAY.HOUR       GASIFIER       PILOT      REGENERATOR  VELOCITY
              AIR  FLUE GAS  PROPANE    AIR  NITROGEN   M/SEC

25.0230       410.      0.      4.9     28.0     3.0      1.49
25.0330       410.      0.      4.9     27.6     4.3      1.51
25.0430       410.      0.      4.9     28.5     5.0      1.59
25.0530       410.      0.      4.9     26.5     4.7      1.48
25.0630       393.     32.      4.9     27.6     4.6      1.54
25.0730       410.      0.      4.9     26.4     4.2      1.44
25.0830       410.      0.      4.9     26.8     4.1      1.45

     SHUT DOWN AT 25.0830 FOR   6 HOURS

25.1430       375.      0.      4.9     27.0     4.6      1.53
25.1530       375.      0.      4.9     26.6     5.0      1.51

     SHUT DOWN AT 25.1530 FOR   7 HOURS

25.2230       444.      0.      4.9     32.6     4.0      1.73
25.2330       444.      0.      4.9     32.8     4.8      1.79
26.0030       444.      0.      4.9     31.5     5.5      1.88
26.0130       410.      0.      4.9     32.3     5.0      1.86
26.0230       410.     13.      4.9     27.9     6.2      1.61
26.0330       410.     13.      4.9     26.5     6.1      1.50
26.0430       410.     13.      4.9     27.1     5.5      1.56
26.0530       427.      0.      4.9     22.0     5.3      1.31
26.0630       427.      0.      4.9     20.3     5.8      1.33
26.0730       427.      0.      4.9     21.1     5.5      1.29
26.0830       375.      0.      4.9     21.5     5.5      1.27

     SHUT DOWN AT 26.0830 FOR  14 HOURS

26.2230       444.      0.      4.9     36.4     4.6      1.77
26.2330       444.      0.      4.9     41.4     4.6      2.04
27.0030       444.      0.      4.9     42.3     4.6      2.11
27.0130       444.      0.      4.9     42.3     4.6      2.10
27.0230       444.      0.      4.9     45.0     4.7      2.24
27.0330       462.      0.      4.9     44.3     4.6      2.10
27.0430       444.      0.      4.9     41.9     3.8      2.00
27.0530       470.      0.      4.9     42.0     3.8      2.03
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APPENDIX 9. TABLE II.

RUN 9: GAS FLOW RATES PAGE 14 OF 16

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	FLUE GAS	PILOT PROPANE	REGENERATOR AIR	NITROGEN	REGEN. VELOCITY M/SEC
27.0630	402.	0.	4.9	41.6	3.1	2.02
27.0730	402.	0.	4.9	45.5	3.3	2.19
27.0830	427.	0.	4.9	46.0	3.5	2.26
27.0930	427.	0.	4.9	43.2	4.1	2.13
27.1030	393.	0.	4.9	45.6	3.6	2.10
27.1130	393.	0.	4.9	42.1	3.3	2.05
27.1230	392.	0.	4.9	43.2	4.0	2.09
27.1330	375.	0.	4.9	43.6	3.0	2.11
27.1430	376.	0.	4.9	35.4	3.3	1.75
27.1530	419.	0.	4.9	38.4	3.4	1.88
27.1630	419.	0.	4.9	38.6	3.4	1.89
27.1730	418.	0.	4.9	38.5	3.7	1.90
27.1830	419.	0.	4.9	38.7	3.8	1.98
27.1930	417.	0.	4.9	40.5	3.8	2.08
27.2030	393.	0.	4.9	40.7	3.6	2.00
27.2130	376.	0.	4.9	43.3	4.0	2.13
27.2230	376.	0.	4.9	40.4	3.5	1.90
27.2330	419.	0.	4.9	38.2	3.2	1.85
28.0030	411.	0.	4.9	40.0	3.4	1.95
28.0130	411.	0.	4.9	39.7	3.3	1.93
28.0230	393.	0.	4.9	39.9	3.3	1.89
28.0330	356.	0.	4.9	41.2	3.3	1.99
28.0430	388.	0.	4.9	36.1	2.9	1.75
28.0530	375.	0.	4.9	37.5	3.5	1.82
28.0630	372.	0.	4.9	39.9	3.4	1.93
28.0730	368.	0.	4.9	37.2	3.6	1.82
28.0830	376.	0.	4.9	35.7	3.0	1.73
28.0930	376.	0.	4.9	38.4	3.2	1.86
28.1030	376.	0.	4.9	37.5	3.3	1.83
28.1130	376.	0.	4.9	37.3	3.3	1.81
28.1230	377.	0.	4.9	36.7	3.7	1.85
28.1330	387.	0.	4.9	38.6	3.6	1.87
28.1430	387.	0.	4.9	39.5	3.4	1.98
28.1530	390.	0.	4.9	47.2	3.0	2.27
28.1630	390.	0.	4.9	48.7	3.6	2.34
28.1730	390.	0.	4.9	49.0	3.1	2.38
28.1830	379.	0.	4.9	51.9	3.9	2.47
28.1930	370.	0.	4.9	46.1	3.3	2.21
28.2030	390.	0.	4.9	41.0	2.8	2.00
28.2130	370.	0.	5.0	40.3	3.2	1.98

APPENDIX G: TABLE II.
RUN 9: GAS FLOW RATES PAGE 15 OF 16

	G A S	R A T E S	M3/HR			REGEN.
DAY.HOUR	GASIFIER		PILOT	REGENERATOR		VELOCITY
	AIR	FLUE GAS	PROPANE	AIR	NITROGEN	M/SEC
28.2230	345.	0.	5.0	40.0	2.0	1.93
SHUT DOWN AT 28.2230 FOR 24 HOURS						
29.2330	406.	87.	4.9	30.5	4.5	1.53
30.0030	440.	87.	4.9	30.3	5.2	1.58
30.0130	475.	88.	4.9	30.6	4.1	1.57
30.0230		MISSED DATA READING				
30.0330		MISSED DATA READING				
30.0430	406.	107.	4.9	31.6	2.6	1.55
30.0530	371.	147.	4.9	31.2	4.1	1.61
30.0630	373.	0.	4.9	35.2	4.2	1.79
30.0730	356.	0.	4.9	31.7	4.1	1.62
30.0830	344.	0.	4.9	34.6	4.4	1.76
30.0930	361.	0.	4.9	31.5	3.8	1.59
30.1030	344.	0.	4.9	24.2	3.6	1.27
30.1130	344.	0.	4.9	27.7	2.4	1.37
30.1230	344.	0.	4.9	30.7	2.5	1.33
30.1330	344.	0.	4.9	27.7	2.8	1.39
30.1430	344.	0.	4.9	28.9	2.6	1.44
30.1530	344.	0.	4.9	26.9	2.6	1.34
30.1630	344.	0.	4.9	28.6	2.8	1.43
30.1730	361.	0.	4.9	28.8	2.7	1.40
30.1830	351.	0.	4.9	28.7	3.8	1.45
30.1930	361.	0.	4.9	27.6	2.8	1.39
30.2030	361.	0.	4.8	28.2	1.5	1.36
30.2130	361.	0.	4.9	28.4	2.3	1.48
30.2230	370.	27.	4.9	34.6	4.1	1.70
30.2330	413.	0.	4.9	30.4	3.7	1.83
31.0030	344.	0.	4.9	35.2	3.3	1.76
31.0130	345.	0.	4.9	34.2	2.5	1.60
31.0230	440.	0.	4.9	34.5	2.6	1.68
31.0330	443.	0.	4.9	38.5	3.6	1.92
31.0430	357.	36.	4.9	40.1	3.9	2.01
31.0530	357.	60.	4.9	34.7	2.8	1.72
31.0630	340.	0.	4.9	26.5	2.3	1.32
31.0730	340.	0.	4.9	31.3	2.3	1.55
31.0830	341.	0.	4.9	32.3	2.4	1.60
31.0930	341.	0.	4.9	32.4	2.4	1.60

APPENDIX G. TABLE 11.
RUN VI GAS FLOW RATES PAGE 16 OF 16

DAY.HOUR	GAS RATES M3/HR GASIFIER AIR	GASIFIER FLUE GAS	PILOT PROPANE	REGENERATOR AIR	REGENERATOR NITROGEN	REGEN. VELOCITY M/SEC
31.1030	361.	0.	4.9	30.5	2.2	1.51
31.1130	380.	0.	4.9	31.9	2.2	1.57
31.1230	361.	0.	4.9	31.8	2.3	1.56
31.1330	340.	0.	4.9	35.0	2.1	1.60
31.1430	340.	0.	4.9	31.0	2.1	1.52
31.1530	340.	0.	4.9	31.3	2.4	1.53
31.1630	381.	72.	4.9	28.9	2.5	1.42
31.1730	382.	75.	4.9	29.4	2.6	1.45
31.1830	372.	75.	4.9	30.7	2.7	1.52
31.1930	490.	0.	4.9	31.8	2.3	1.56
		STONE CHANGE				
31.2030	498.	3.	4.9	28.5	2.8	1.37
31.2130	498.	0.	4.9	30.6	2.4	1.50
31.2230	445.	0.	4.9	31.2	2.6	1.54
31.2330	411.	0.	4.9	31.3	3.0	1.56
32.0030	409.	0.	4.9	31.5	3.0	1.57
32.0130	402.	0.	4.9	30.9	3.0	1.54
32.0230	374.	0.	4.9	30.7	2.8	1.53
32.0330	406.	0.	4.9	29.8	3.0	1.49
32.0430	405.	0.	4.9	29.5	2.9	1.46
32.0530	404.	0.	4.9	28.8	2.6	1.41
32.0630	378.	0.	4.9	28.9	2.6	1.42
32.0730	369.	0.	4.9	28.6	2.5	1.40
32.0830	370.	0.	4.9	29.8	2.5	1.46

APPENDIX C: TABLE III.
RUN 9: PRESSURES   PAGE 1 OF 16

DAY.HOUR	GASIFIER P. KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
1.1930	1.9	2.4	5.5	0.95	5.7
1.2030	1.9	2.4	5.5	0.95	5.7
1.2130	2.9	0.8	5.5	0.95	6.5

SHUT DOWN AT 1.2130 FOR 4 HOURS

DAY.HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	BED SP. GR.	REGEN. BED D.P.
2.0230	2.6	2.4	5.2	1.00	6.2
2.0330	2.6	2.4	5.5	1.00	6.2
2.0430	2.7	2.4	5.6	1.00	6.5
2.0530	2.7	2.5	6.0	1.00	6.0
2.0630	2.9	2.5	6.1	1.00	6.7
2.0730	2.7	2.5	6.1	0.95	6.5
2.0830	2.7	2.5	6.2	1.00	6.7
2.0930	2.9	2.5	6.3	1.00	6.0
2.1030	3.2	2.5	6.2	1.00	6.0
2.1130	3.4	2.5	6.5	1.00	6.5
2.1230	3.4	2.5	6.5	1.00	6.2
2.1330	3.5	2.5	6.6	1.00	6.2
2.1430	3.4	2.5	6.6	1.00	6.0
2.1530	4.6	2.5	6.7	1.00	6.2
2.1630	4.4	2.5	6.8	1.00	6.2
2.1730	4.5	2.4	7.1	1.00	7.5
2.1830	4.4	2.4	7.2	1.00	7.3
2.1930	4.2	2.4	7.2	1.00	7.6
2.2030	4.1	2.4	7.7	1.00	7.0
2.2130	4.2	2.4	7.7	1.00	7.0
2.2230	4.5	2.4	7.6	1.00	7.0
2.2330	5.0	2.5	7.6	1.00	7.0

SHUT DOWN AT 2.2330 FOR 28 HOURS

DAY.HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	BED SP. GR.	REGEN. BED D.P.
4.0430	0.4	2.7	7.0	1.00	0.
4.0530	2.0	2.5	8.1	1.00	0.
4.0630	1.9	2.2	8.3	1.00	0.
4.0730	0.2	0.7	8.6	1.00	0.
4.0830	2.0	2.5	8.7	1.00	0.
4.0930	2.0	0.6	8.0	1.00	0.
4.1030	MISSED DATA READING				

APPENDIX G. TABLE III.
RUN 9: PRESSURES PAGE 8 OF 16

DAY:HOUR	GASIFIER P. KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
4:1230	0.4	4.0	0.6	1.00	0.
4:1330	0.4	4.0	0.7	1.00	0.
4:1430	0.2	4.0	0.7	1.05	0.
4:1530	0.3	3.9	0.7	1.00	0.
4:1630	0.4	4.0	0.5	1.00	0.
4:1730	0.4	4.4	0.5	0.95	0.
4:1830	0.3	4.0	0.7	1.05	0.
4:1930	0.2	4.0	9.0	0.97	0.
4:2030	0.3	4.0	9.1	1.00	0.
4:2130	0.5	4.0	9.0	1.00	0.
4:2230	0.6	4.0	9.0	1.00	0.
4:2330	0.0	4.0	9.0	1.00	0.
5:0030	0.7	4.0	9.0	1.00	0.
5:0130	0.7	4.0	0.7	0.98	0.
5:0230	0.6	4.1	9.0	1.00	0.
5:0330	0.6	4.0	9.0	1.00	0.
5:0430	0.6	3.7	9.3	1.00	0.
5:0530	0.5	3.7	9.3	1.00	0.
5:0630	0.5	3.7	9.5	1.00	0.
5:0730	0.6	3.7	9.7	1.00	0.
5:0830	0.6	3.7	9.7	1.00	0.
5:0930	0.6	3.6	10.0	0.98	0.
5:1030	0.7	3.9	10.0	1.00	0.
5:1130	0.9	4.0	10.1	1.00	0.
5:1230	0.9	3.7	9.0	1.00	0.
5:1330	0.7	3.9	10.1	1.00	0.
5:1430	0.9	4.0	9.5	1.00	0.
5:1530	0.7	4.1	9.0	1.00	0.
5:1630	0.7	4.1	9.6	1.04	0.
5:1730	0.7	4.0	9.7	1.00	0.
5:1830	0.7	4.0	9.0	1.00	0.
5:1930	0.7	4.0	9.7	1.00	0.
5:2030	0.7	4.1	9.0	1.00	0.
5:2130	0.7	4.5	9.7	1.00	0.
5:2230	4.0	4.2	9.0	1.00	0.
5:2330	4.0	4.5	9.7	1.00	0.
6:0030	4.0	4.5	9.7	1.00	0.
6:0130	4.0	4.5	9.7	1.00	0.
6:0230	4.0	4.5	9.7	1.00	0.
6:0330	4.0	4.5	9.7	1.00	0.

APPENDIX G, TABLE III.
RUN 91 PRESSURES PAGE 3 OF 16

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
6.0430	4.0	4.5	9.7	1.00	0.
6.0530	4.0	4.5	9.3	1.00	0.
6.0630	4.0	4.5	9.5	1.00	0.
6.0730	4.0	4.5	9.0	1.00	0.
6.0830	4.0	4.8	8.6	1.00	0.
6.0930	4.0	4.8	9.1	1.00	0.
6.1030	4.0	5.0	9.0	1.00	0.
6.1130	4.0	5.6	8.8	1.00	0.
6.1230	4.1	5.6	8.8	1.00	0.
6.1330	4.1	5.6	8.6	1.00	0.
6.1430	4.0	5.6	8.3	0.95	0.
6.1530	3.7	5.4	8.5	0.95	0.
6.1630	4.0	5.5	7.7	0.95	0.
6.1730	3.9	5.5	8.1	1.00	0.
6.1830	3.9	5.5	8.1	1.00	0.
6.1930	3.4	5.0	7.8	1.00	0.
6.2030	3.4	5.0	7.6	1.00	0.

SHUT DOWN AT 6.2030 FOR 4 HOURS

DAY.HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	SP. GR.	REGEN. BED D.P.
7.0130	3.3	4.7	7.7	1.12	0.
7.0230	3.9	5.0	7.7	1.00	0.
7.0330	3.9	5.0	8.1	1.00	0.
7.0430	3.9	5.0	8.1	1.00	0.
7.0530	3.7	5.1	8.0	1.00	0.
7.0630	3.5	5.1	8.0	1.00	0.
7.0730	3.5	5.0	8.0	1.00	0.
7.0830	3.5	5.0	8.0	1.00	0.
7.0930	3.6	5.0	8.3	1.00	0.
7.1030	4.0	5.0	8.3	1.00	0.
7.1130	4.0	5.0	8.5	1.00	10.5
7.1230	4.1	5.0	8.5	1.00	10.5
7.1330	4.1	6.7	8.6	1.00	10.6
7.1430	4.0	6.8	8.7	1.00	10.7
7.1530	4.0	6.8	8.8	1.00	10.7
7.1630	4.4	6.5	9.5	1.00	10.4
7.1730	4.1	6.8	10.1	1.00	10.4
7.1830	4.1	6.5	10.7	1.00	10.1
7.1930	4.1	6.5	10.9	1.00	11.9

APPENDIX G. TABLE III:
RUN 9: PRESSURES PAGE 4 OF 16

DAY:HOUR	GASIFIER P. KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
7:2030	4.1	0.5	11.0	1.00	10.2
7:2130	4.4	0.5	10.7	1.00	11.9
7:2230	4.4	0.5	10.7	1.00	12.4
7:2330	4.4	0.6	10.7	1.00	12.4
8:0030	4.4	0.6	10.7	1.00	13.7
8:0130	4.4	0.6	10.7	1.00	13.7
8:0230	4.4	0.7	10.7	1.00	13.7
8:0330	4.4	0.7	10.9	1.00	13.7
8:0430	4.4	0.7	10.8	1.00	13.7
8:0530	4.4	0.7	10.8	1.00	13.7
8:0630	4.4	0.7	10.8	1.00	13.7
8:0730	4.5	0.7	10.8	1.00	13.7
8:0830	4.5	0.7	10.9	1.00	13.7
8:0930	4.5	0.7	11.0	1.00	13.7
8:1030	4.5	0.7	11.0	1.00	13.7
8:1130	4.5	0.7	11.3	1.00	13.7
8:1230	4.5	0.7	11.3	1.00	13.7
8:1330	4.5	0.7	11.3	1.00	13.7
8:1430	4.5	0.7	11.6	1.00	13.7
8:1530	4.0	0.5	11.6	1.00	13.7
8:1630	4.0	0.5	11.8	1.00	13.7
8:1730	4.5	0.7	11.6	1.00	13.7
8:1830	4.5	0.5	11.7	1.00	13.7
8:1930	4.5	0.7	11.6	1.00	13.7
8:2030	4.7	0.7	11.6	1.00	13.7
8:2130	5.0	0.6	11.6	1.00	13.7

SHUT DOWN AT 8:2130 FOR 8 HOURS

DAY:HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	SP. GR.	REGEN. BED D.P.
9:0630	3.2	0.6	10.6	0.98	13.7
9:0730	3.0	0.7	10.9	0.90	13.7
9:0830	3.4	0.7	10.9	1.00	12.4
9:0930	3.5	0.8	10.7	1.00	12.4
9:1030	3.5	0.7	10.7	1.00	12.4
9:1130	3.5	0.8	10.9	1.00	12.4
9:1230	3.5	0.8	10.8	1.00	12.4
9:1330	3.5	0.8	10.8	1.00	12.4
9:1430	3.5	0.8	10.5	1.00	12.4
9:1530	3.7	0.8	10.2	1.00	12.4

APPENDIX D, TABLE III.
RUN 9: PRESSURES PAGE 5 OF 16

DAY.HOUR	GASIFIER P. KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
9.1630	3.7	3.0	10.5	1.00	12.4
9.1730	3.7	3.0	10.5	1.00	12.4
9.1830	3.7	3.0	10.6	1.00	12.4
9.1930	3.7	3.0	10.7	1.00	12.4
9.2030	3.7	3.0	10.9	1.00	12.4

SHUT DOWN AT 9.2030 FOR 5 HOURS

DAY.HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	SP. GR.	REGEN. BED D.P.
10.0230	2.9	2.6	10.7	1.00	13.7
10.0330	2.9	2.7	10.9	1.00	13.7
10.0430	3.4	2.7	10.9	1.00	13.7
10.0530	3.5	2.9	11.1	1.00	13.7
10.0630	3.6	2.9	11.3	1.00	13.7
10.0730	3.6	2.9	11.3	1.00	13.7
10.0830	3.7	3.1	11.3	1.00	13.7
10.0930	3.7	3.0	11.6	1.00	12.9
10.1030	3.5	3.0	11.4	1.00	12.6
10.1130	3.7	3.0	11.4	1.00	12.6
10.1230	3.7	3.0	11.4	1.00	12.6
10.1330	3.7	3.0	11.4	1.00	12.6
10.1430	3.7	2.7	11.4	1.00	12.6
10.1530	3.7	2.7	11.4	1.00	12.6
10.1630	3.7	2.7	11.4	1.00	12.6
10.1730	3.7	2.7	11.7	1.00	12.6
10.1830	3.6	2.7	11.4	1.00	12.6
10.1930	3.6	2.7	11.4	1.00	12.4
10.2030	3.6	2.7	11.3	1.00	12.4
10.2130	3.6	2.7	11.7	1.00	12.4
10.2230	3.6	2.7	11.7	1.00	11.2
10.2330	3.6	2.9	11.7	1.00	9.5
11.0030	3.6	2.7	11.7	1.00	10.0
11.0130	3.7	2.7	11.4	1.00	10.5
11.0230	3.6	2.7	11.2	1.00	11.2
11.0330	3.6	2.7	11.2	1.00	11.3
11.0430	3.7	2.7	10.9	1.00	11.1
11.0530	3.5	2.5	11.0	1.00	10.7
11.0630	3.5	2.5	11.3	1.00	10.7
11.0730	3.6	2.6	11.7	1.00	10.5
11.0830	3.6	2.6	11.6	1.00	10.6

APPENDIX G, TABLE III.
RUN 9: PRESSURES PAGE 6 OF 16

DAY:HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
11:0930	3.7	2.9	11.4	1.00	10.6
11:1030	3.9	2.7	11.3	1.00	10.7
11:1130	3.9	2.8	11.2	1.00	11.3
11:1230	4.0	3.0	10.9	1.00	11.7
11:1330	4.0	3.0	11.1	1.00	11.8
11:1430	3.7	3.0	11.1	1.00	11.8
11:1530	3.7	3.0	11.4	1.00	11.8
11:1630	3.7	2.7	11.4	1.00	11.8
11:1730	3.8	2.7	11.6	1.00	11.8
11:1830	3.9	2.9	11.4	1.00	11.8
11:1930	4.0	3.0	11.4	1.06	11.8
11:2030	4.0	3.0	11.4	1.00	11.8
11:2130	4.0	3.0	11.4	1.00	11.9
11:2230	4.0	3.0	11.4	1.00	11.9
11:2330	4.0	3.0	11.4	1.05	11.9
12:0030	3.7	2.4	11.4	1.05	11.7
12:0130	3.8	2.4	11.6	1.00	11.9
12:0230	3.6	2.4	11.6	1.00	11.9
12:0330	3.5	2.4	11.7	1.00	11.9
12:0430	3.6	2.4	11.7	1.00	11.7
12:0530	3.6	2.5	11.7	1.00	11.9
12:0630	3.6	2.6	11.7	1.00	11.9
12:0730	3.6	2.7	11.7	1.00	11.9
12:0830	3.7	2.5	11.6	1.00	11.9
12:0930	3.7	2.6	11.7	1.00	12.4
12:1030	3.7	2.6	11.6	1.00	12.4
12:1130	3.6	2.6	11.7	1.00	12.4
12:1230	3.6	2.6	11.6	1.00	11.9
12:1330	3.7	2.7	11.7	1.00	11.7
12:1430	3.7	2.7	11.8	1.00	11.7
12:1530	3.7	2.6	11.8	1.00	11.9
12:1630	3.7	2.7	11.8	1.00	11.9
12:1730	3.7	2.7	11.8	1.00	12.4
12:1830	3.9	2.7	11.7	1.00	12.4
12:1930	3.9	2.7	11.7	1.00	12.4
12:2030	3.9	2.7	11.7	1.00	12.4
12:2130	3.9	2.7	11.7	1.00	12.4
12:2230	3.9	2.6	11.7	1.00	12.4
12:2330	4.0	2.6	11.8	1.00	12.7
13:0030	4.1	2.6	11.8	1.00	12.4

APPENDIX D, TABLE III.
RUN 9: PRESSURES

PAGE 7 OF 16

	GASIFIER P, KILOPASCALS			GASIFIER	REGEN.
DAY.HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	BED SP. GR.	BED D.P.
13.0130	4.1	0.6	11.8	1.00	10.4
13.0230	4.1	0.6	11.9	1.00	10.7
13.0330	4.2	0.5	11.9	1.00	10.7
13.0430	4.2	0.5	10.1	1.00	10.7
13.0530	4.0	0.5	10.1	1.00	10.7
13.0630	4.0	0.5	10.1	1.00	10.7
13.0730	4.7	0.6	11.0	1.00	10.7
13.0830	4.9	0.6	11.0	1.00	10.7
13.0930	4.7	0.7	11.7	1.00	10.9
13.1030	4.9	0.6	11.0	1.00	11.9
13.1130	4.9	0.6	11.7	1.00	11.9

SHUT DOWN AT 13.1130 FOR 13 HOURS

14.0130	3.4	4.0	10.1	1.00	10.6
14.0230	3.4	3.9	10.3	1.00	10.7
14.0330	3.8	3.7	10.6	1.00	11.0
14.0430	3.8	3.7	10.8	1.00	11.7
14.0530	3.8	3.7	10.9	1.00	11.8
14.0630	3.8	3.7	11.1	1.00	11.9
14.0730	3.8	3.7	11.3	1.00	12.2
14.0830	3.5	3.7	11.7	1.00	12.4
14.0930	3.8	4.0	11.6	1.00	13.7
14.1030	3.5	4.0	10.1	1.00	7.0
14.1130	3.6	4.0	11.0	1.00	7.0
14.1230	3.8	3.9	11.3	1.00	10.0
14.1330	3.8	3.1	10.9	1.00	10.3
14.1430	3.8	3.1	10.9	1.00	10.9
14.1530	3.8	2.7	11.1	1.00	10.8
14.1630	3.4	2.9	11.1	1.00	10.7
14.1730	3.9	2.9	10.5	1.00	10.7
14.1830	3.9	3.0	10.5	1.00	10.7
14.1930	4.0	3.5	10.6	1.00	11.4
14.2030	4.1	3.0	10.7	1.00	11.4
14.2130	4.4	3.0	10.7	1.00	11.7
14.2230	3.9	3.1	10.9	1.00	11.7
14.2330	4.1	3.1	10.8	1.00	11.7
15.0030	4.2	3.1	10.8	1.00	11.7
15.0130	4.0	3.4	10.8	1.00	11.7

APPENDIX D, TABLE III,
RUN 91 PRESSURES PAGE 8 OF 16

DAY:HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
15:0230	4.4	3.4	10.9	1.00	11.0
15:0330	4.5	3.5	10.9	1.00	11.7
15:0430	4.4	3.6	11.1	1.00	11.1
15:0530	3.7	3.6	11.7	1.00	11.9
15:0630	4.1	3.5	11.0	1.00	11.9
15:0730	4.0	3.0	10.0	1.00	10.5
15:0830	4.5	3.1	10.7	1.00	10.0
15:0930	4.9	3.4	10.9	1.00	9.7
15:1030	4.7	3.5	10.9	1.00	10.5
15:1130	5.5	3.4	10.9	1.00	10.5
15:1230	5.0	3.4	10.9	1.00	9.8
15:1330	5.7	3.0	10.9	1.00	10.2
15:1430	5.6	2.9	10.9	1.00	10.0
15:1530	5.7	2.9	10.9	1.00	10.5
15:1630	5.7	2.9	10.9	1.00	10.9
SHUT DOWN AT 15:1630 FOR 14 HOURS					
16:0730	3.6	4.9	9.3	1.00	10.6
16:0830	3.5	5.0	9.6	1.00	10.2
16:0930	3.6	5.1	9.7	1.00	10.3
16:1030	3.7	6.0	10.0	1.00	9.5
16:1130	4.1	7.0	10.1	1.00	9.7
16:1230	4.0	6.0	10.1	1.00	9.7
16:1330	4.0	6.0	10.0	1.00	9.7
16:1430	4.0	7.0	9.0	1.00	9.7
16:1530	3.7	7.0	10.0	1.00	9.7
16:1630	MISSED DATA READING				
16:1730	3.7	7.5	9.6	1.00	9.5
16:1830	3.1	8.0	10.0	1.00	9.2
16:1930	3.0	8.0	10.0	1.00	9.5
16:2030	3.1	7.7	10.6	1.00	9.0
16:2130	3.0	8.0	10.0	1.00	9.3
16:2230	3.0	8.0	10.0	1.00	9.3
16:2330	3.0	8.0	10.0	1.00	9.3
17:0030	MISSED DATA READING				
17:0130	MISSED DATA READING				
17:0230	3.9	7.0	9.7	1.00	10.0
17:0330	4.0	7.0	9.0	1.00	10.5

APPENDIX D, TABLE III.
RUN 9: PRESSURES PAGE 9 OF 16

DAY.HOUR	GASIFIER P, KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
17.0530	4.0	7.2	9.7	1.00	10.6
17.0630	4.1	7.2	10.0	1.00	10.2
17.0730	4.1	7.0	9.0	1.00	10.5
17.0830	4.0	7.0	9.7	1.00	10.3
17.0930	4.0	7.5	9.7	1.00	10.5
17.1030	4.2	7.2	9.7	1.00	9.2
17.1130	4.0	7.0	9.7	1.00	9.3
17.1230	4.2	7.0	9.0	1.00	9.5
17.1330	4.2	7.0	9.0	1.00	9.0
17.1430	4.0	7.0	8.3	1.00	9.0
17.1530	4.0	7.0	9.3	1.00	8.7
17.1630	4.6	7.7	9.1	1.00	8.7
17.1730	4.6	7.6	9.6	1.00	10.0
17.1830	4.5	8.0	9.5	1.00	9.0
17.1930	5.1	7.0	9.0	1.00	9.0
17.2030	5.5	7.5	9.0	1.00	9.0
17.2130	4.9	7.0	9.7	1.00	9.0
17.2230	4.7	6.5	9.7	1.00	11.2
17.2330	4.7	6.5	9.7	1.00	11.2
18.0030	5.0	6.5	9.7	1.00	11.2
18.0130	5.0	6.0	9.7	1.00	11.0
18.0230	4.9	6.5	9.7	1.00	11.3
18.0330	4.9	6.2	9.0	1.00	11.4
18.0430	5.0	6.0	9.0	1.00	11.4
18.0530	5.1	6.0	9.0	1.00	11.7
18.0630	5.1	6.2	10.0	1.00	11.0
18.0730	5.2	6.5	10.0	1.00	11.4
18.0830	5.2	6.5	10.1	1.00	11.0
18.0930	5.2	6.0	10.1	1.00	11.0
18.1030	5.2	6.2	10.0	1.00	11.4
18.1130	5.2	6.3	10.0	1.00	11.6
18.1230	5.0	5.0	10.2	1.00	10.7
18.1330	5.2	7.1	10.0	1.00	10.9
18.1430	5.2	5.5	10.0	1.00	7.3
18.1530	5.4	4.9	10.0	1.00	9.5
18.1630	4.6	4.9	10.7	1.00	7.0
18.1730	4.7	4.7	10.0	1.00	7.0
18.1830	4.9	6.2	10.5	1.00	6.1
18.1930	4.6	5.7	10.6	1.00	6.0
18.2030	4.7	5.7	10.6	1.00	7.0

APPENDIX D. TABLE III.
RUN 9: PRESSURES PAGE 18 OF 18

	GASIFIER P, KILOPASCALS			GASIFIER	REGEN.
DAY.HOUR	GAS SPACE	DISTRIB. D.P.	BED D.P.	BED SP. GR.	BED D.P.
18.2130	4.5	5.7	10.5	1.02	11.2
18.2230	3.9	4.5	10.3	1.00	10.7
18.2330	4.5	5.7	10.2	1.00	9.5
19.0030	4.4	5.5	10.0	1.00	10.0
19.0130	4.5	5.6	9.7	1.00	9.5
19.0230	4.5	5.0	9.5	1.00	9.5
19.0330	4.7	5.8	9.5	1.00	9.5
19.0430	5.0	5.0	9.0	1.00	10.5
19.0530	4.9	5.2	9.3	1.00	10.5
19.0630	5.2	5.2	9.1	1.00	10.6
19.0730	4.6	5.1	9.1	1.00	10.6
19.0830	4.7	5.0	9.0	1.00	10.5
19.0930	4.9	5.0	9.1	1.00	10.7
19.1030	4.7	4.5	9.3	1.00	10.7
19.1130	4.7	4.6	9.4	1.00	10.7
19.1230	4.7	4.5	9.5	1.00	10.6
19.1330	4.5	4.4	9.5	1.00	10.6
19.1430		MISSED DATA READING			
19.1530	4.7	5.0	10.0	1.00	9.0
19.1630	4.7	5.0	10.0	1.00	7.7
19.1730	5.0	4.7	10.3	1.00	8.5
19.1830	5.0	4.7	10.2	1.00	8.5
19.1930	5.0	4.7	10.3	1.00	8.6
19.2030	4.9	4.7	10.6	1.00	9.2
19.2130	5.1	4.9	10.5	1.00	10.0
19.2230	5.4	4.9	10.2	1.00	11.2
		STONE CHANGE			
19.2330	5.4	4.9	10.3	1.00	11.4
20.0030	5.4	4.7	10.5	1.00	11.4
20.0130	5.2	4.6	10.6	1.00	11.7
20.0230	5.2	4.6	10.7	1.00	11.7
20.0330	5.1	4.4	10.7	1.00	11.7
20.0430	5.1	4.4	10.7	1.00	11.4
20.0530	5.1	4.4	10.6	1.00	11.4
20.0630	5.1	4.4	10.5	1.00	11.4
20.0730	5.1	4.4	10.5	1.00	10.5
20.0830	5.1	4.4	10.3	1.00	10.9
		STONE CHANGE			
20.0930	5.1	4.4	10.5	1.00	10.7
20.1030	5.2	4.5	10.6	1.00	9.7

APPENDIX 9, TABLE III.
RUN 9: PRESSURES   PAGE 11 OF 16

DAY:HOUR	GASIFIER P, KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
00:1130	5.5	4.5	10.2	1.00	9.1
00:1230	5.6	4.6	9.8	1.00	10.0
00:1330	5.7	4.6	9.7	1.00	9.7
00:1430	5.7	4.6	9.8	1.00	10.0
00:1530	5.8	4.6	9.7	1.00	10.9
00:1630	5.8	4.6	9.7	1.00	10.9
00:1730	5.9	4.6	9.7	1.00	10.9
00:1830	5.9	4.6	9.7	1.00	11.0
00:1930	5.9	4.7	9.7	1.00	10.7
00:2030	6.1	4.5	9.3	1.05	10.5
SHUT DOWN AT 00:2030 FOR 35 HOURS					
02:0830	3.6	7.0	9.3	1.00	7.7
02:0930		MISSED DATA READING			
02:1030	3.6	7.3	8.6	1.00	6.0
02:1130	3.4	6.0	8.8	1.00	8.0
02:1230	3.0	5.7	9.0	1.00	7.7
02:1330	3.4	5.4	9.5	1.00	8.3
02:1430	3.4	5.0	9.7	1.00	8.8
02:1530	3.4	5.0	10.0	1.00	8.3
02:1630	3.4	5.0	10.2	1.00	8.3
02:1730	3.4	5.0	10.0	1.00	8.1
02:1830	3.1	4.5	10.5	1.00	9.1
02:1930	2.9	4.7	10.7	1.00	8.7
02:2030	2.9	4.7	10.7	1.00	9.1
02:2130	2.9	4.7	10.7	1.00	9.0
02:2230	2.7	4.5	10.9	1.00	9.5
02:2330	2.6	5.1	10.9	1.00	9.7
03:0030	2.5	5.0	11.1	1.00	9.5
03:0130	2.5	5.1	11.1	1.00	9.0
03:0230	2.5	5.0	10.9	1.00	9.2
03:0330	2.5	5.0	10.8	1.00	9.2
03:0430	2.5	5.1	10.9	1.00	9.2
03:0530	2.5	5.0	10.9	1.00	9.0
03:0630	2.5	5.6	10.6	1.00	9.5
03:0730	2.5	5.6	10.6	1.00	9.5
03:0830	2.5	5.5	10.7	1.00	10.5
03:0930	2.5	5.7	10.0	1.00	10.0

APPENDIX G: TABLE III.
RUN 9: PRESSURES PAGE 12 OF 16

DAY:HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
03:1030	2.7	5.4	10.0	1.00	9.5
03:1130	2.9	5.0	10.0	1.00	9.5
03:1230	2.9	5.0	10.0	1.00	9.0
03:1330	2.9	6.1	9.7	1.00	8.5
03:1430	2.9	6.4	9.5	1.00	9.0
03:1530	2.9	6.1	9.0	1.00	7.0
03:1630	2.9	6.3	10.1	1.00	6.0
03:1730	3.0	6.5	10.0	1.00	6.0
03:1830	3.1	7.0	9.0	1.00	5.7
03:1930	3.1	7.7	8.7	1.00	5.5
03:2030	2.6	0.	9.3	1.00	6.0
03:2130	2.7	0.	9.5	1.00	7.0
03:2230	2.7	0.	9.6	1.30	7.5
03:2330	2.7	0.	9.7	1.05	8.5
04:0030	2.9	0.	10.1	1.05	7.5
04:0130	3.0	0.	10.1	1.00	8.0
04:0230	3.0	0.	10.0	1.00	7.0
04:0330	3.4	0.	10.3	1.00	8.0
04:0430	3.0	0.	10.3	1.00	7.0
04:0530	3.0	0.	10.3	1.00	6.7
04:0630	3.0	0.	10.0	1.00	6.5
04:0730	3.0	0.	10.1	1.00	6.0
04:0830	3.4	0.	10.0	1.00	8.0
04:0930	3.5	0.	10.1	1.00	7.0
04:1030	3.6	0.	10.3	1.00	9.3
04:1130	3.6	0.	10.7	1.00	8.7
04:1230	3.6	0.	10.8	1.00	8.7
04:1330	3.6	0.	10.9	1.00	9.3
04:1430	3.7	0.	10.9	1.00	9.5
04:1530	3.7	0.	11.1	1.00	9.7
04:1630	3.7	0.	11.1	1.00	9.8
04:1730	3.7	0.	11.0	1.00	10.0
04:1830	3.7	0.	11.0	1.00	10.0
04:1930	3.7	0.	11.0	1.00	10.0
04:2030	3.7	0.	11.0	1.00	10.5
04:2130	3.7	0.	11.4	1.00	10.6
04:2230	3.7	0.	11.3	1.00	10.6
04:2330	3.9	0.	11.1	1.00	10.7
05:0030	3.7	0.	11.1	1.00	10.9
05:0130	3.7	0.	11.0	1.00	11.0

APPENDIX D, TABLE III.
RUN 9: PRESSURES PAGE 13 OF 16

DAY:HOUR	GASIFIER P. KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
05:0230	3.9	0.	11.6	1.00	11.5
05:0330	3.7	0.	11.7	1.00	11.6
05:0430	3.7	0.	11.9	1.00	11.4
05:0530	3.9	0.	11.8	1.00	11.7
05:0630	4.0	0.	11.8	1.00	11.4
05:0730	4.0	0.	11.8	1.00	11.4
05:0830	4.4	0.	11.7	1.00	11.7
SHUT DOWN AT 05:0830 FOR 6 HOURS					
05:1430	4.7	0.	11.8	1.00	10.0
05:1530	5.0	0.	11.4	1.00	11.0
SHUT DOWN AT 05:1530 FOR 7 HOURS					
05:2230	3.5	0.	10.7	1.00	9.5
05:2330	3.5	0.	10.7	1.00	9.0
06:0030	3.0	0.	10.6	1.00	9.0
06:0130	3.4	0.	10.6	1.00	10.0
06:0230	3.4	0.	10.7	1.00	10.7
06:0330	3.4	0.	10.8	1.00	10.7
06:0430	3.4	0.	10.8	1.00	11.0
06:0530	3.4	0.	10.8	1.00	11.9
06:0630	3.4	0.	10.8	1.00	11.7
06:0730	3.4	0.	10.9	1.00	11.7
06:0830	3.5	0.	10.9	1.00	11.4
SHUT DOWN AT 06:0830 FOR 14 HOURS					
06:2230	2.7	3.1	9.2	1.00	9.0
06:2330	2.7	3.1	9.8	1.00	9.0
07:0030	3.7	3.1	10.0	1.00	7.6
07:0130	3.6	3.0	10.5	1.00	7.8
07:0230	3.6	3.1	10.5	1.00	7.5
07:0330	3.6	3.1	10.7	1.00	7.7
07:0430	3.6	3.0	10.8	1.00	8.0
07:0530	3.9	3.0	10.9	1.00	8.7

APPENDIX G: TABLE III.
RUN 9: PRESSURES PAGE 14 OF 16

DAY:HOUR	GASIFIER P, KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
07:0630	3.9	3.1	11.1	1.00	8.7
07:0730	4.0	3.1	10.9	1.00	8.8
07:0830	4.0	3.1	10.7	1.00	7.5
07:0930	4.0	3.4	10.7	1.00	7.8
07:1030	4.0	3.4	10.8	1.00	8.1
07:1130	4.0	3.6	10.7	1.00	8.5
07:1230	4.2	3.6	10.7	1.00	8.7
07:1330	4.0	3.6	10.5	1.00	8.7
07:1430	4.0	3.5	10.6	1.00	9.0
07:1530	4.5	3.5	10.8	1.00	9.5
07:1630	4.5	3.6	10.8	1.00	9.5
07:1730	4.5	3.6	10.9	1.00	9.5
07:1830	4.5	3.7	10.8	1.00	10.6
07:1930	4.5	3.6	10.8	1.00	10.5
07:2030	4.7	3.6	10.8	1.00	10.5
07:2130	4.7	3.8	11.1	1.00	10.5
07:2230	4.7	3.8	11.0	1.00	10.5
07:2330	4.7	3.8	11.0	1.00	10.4
08:0030	5.0	3.0	10.9	1.00	11.2
08:0130	4.9	3.0	10.9	1.00	11.0
08:0230	4.7	3.0	11.0	1.00	11.0
08:0330	4.7	2.9	11.0	1.00	11.4
08:0430	4.7	2.7	11.4	1.00	11.6
08:0530	4.7	3.0	11.4	1.00	11.7
08:0630	4.9	3.1	11.3	1.00	11.7
08:0730	5.0	3.1	11.4	1.00	11.8
08:0830	5.0	2.7	11.4	1.00	11.8
08:0930	5.0	2.7	11.6	1.00	11.9
08:1030	4.9	2.6	11.7	1.00	11.9
08:1130	5.1	2.7	11.7	1.00	12.0
08:1230	5.0	2.7	11.7	1.00	11.9
08:1330	5.6	2.5	11.7	1.00	12.1
08:1430	6.0	2.0	12.1	1.00	11.7
08:1530	6.0	2.0	12.1	1.00	11.7
08:1630	6.3	2.0	11.6	1.00	11.4
08:1730	5.7	2.1	11.7	1.00	11.4
08:1830	5.0	1.9	11.6	1.00	10.0
08:1930	5.5	2.0	11.1	1.00	12.0
08:2030	5.6	2.4	10.9	1.02	11.2
08:2130	5.5	0.	10.2	1.00	11.2

APPENDIX G: TABLE III.
RUN 9: PRESSURES   PAGE 15 OF 16

DAY.HOUR	GASIFIER P. KILOPASCALS GAS SPACE	DISTRIB. D.P.	BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
28.2230	3.0	0.	10.2	1.00	11.2
SHUT DOWN AT 28.2230 FOR 24 HOURS					
29.2330	3.2	3.5	7.1	1.00	8.1
30.0030	3.5	4.1	7.2	1.00	8.5
30.0130	3.7	6.7	7.5	1.00	8.5
30.0230	MISSED DATA READING				
30.0330	MISSED DATA READING				
30.0430	4.1	5.2	7.2	1.00	9.2
30.0530	3.6	5.8	7.5	1.00	8.7
30.0630	3.0	2.5	7.6	1.00	8.1
30.0730	2.7	2.2	8.1	1.00	8.1
30.0830	2.6	2.8	8.3	1.00	8.1
30.0930	2.5	2.8	8.5	1.00	8.7
30.1030	2.5	2.8	8.5	1.00	8.7
30.1130	2.5	2.1	8.5	1.00	8.7
30.1230	2.6	2.1	8.5	1.00	8.7
30.1330	2.6	2.1	8.5	1.00	9.0
30.1430	2.6	2.1	8.3	1.00	8.7
30.1530	2.6	2.1	8.1	1.00	8.5
30.1630	2.7	2.1	8.0	1.00	8.2
30.1730	2.7	3.1	7.8	1.00	8.2
30.1830	2.9	2.1	7.5	1.00	8.1
30.1930	3.1	19.9	7.1	1.00	7.7
30.2030	3.0	0.0	7.1	1.00	7.7
30.2130	3.7	2.5	7.0	1.00	8.0
30.2230	1.7	3.1	7.1	1.00	7.5
30.2330	7.7	3.0	7.1	1.00	8.0
31.0030	3.7	2.9	7.0	1.00	8.0
31.0130	3.7	2.9	7.3	1.00	8.2
31.0230	4.2	3.1	7.3	1.00	9.0
31.0330	4.6	3.4	7.5	1.00	9.2
31.0430	4.0	2.4	7.7	1.00	6.7
31.0530	3.6	2.4	7.6	1.00	7.7
31.0630	3.7	2.5	7.7	1.00	8.2
31.0730	3.6	2.5	8.2	1.00	8.0
31.0830	3.7	2.4	8.0	1.00	8.1
31.0930	3.7	2.4	8.0	1.00	8.1

APPENDIX G. TABLE III.
RUN 9: PRESSURES PAGE 16 OF 16

DAY:HOUR	GASIFIER P. KILOPASCALS GAS SPACE	 DISTRIB. D.P.	 BED D.P.	GASIFIER BED SP. GR.	REGEN. BED D.P.
31:1030	3.7	2.4	8.1	1.00	8.2
31:1130	4.1	2.4	7.0	1.00	8.5
31:1230	4.0	2.4	7.0	1.00	8.5
31:1330	3.9	2.4	7.0	1.00	8.2
31:1430	3.9	2.4	8.7	1.00	9.2
31:1530	5.6	3.6	8.6	1.00	10.9
31:1630	5.5	4.4	8.2	1.00	10.9
31:1730	5.7	4.7	7.0	1.00	10.7
31:1830	5.5	4.6	8.0	1.00	10.2
31:1930	5.1	3.7	7.0	1.00	9.5
STONE CHANGE					
31:2030	5.2	3.5	8.1	1.00	10.0
31:2130	4.6	3.5	8.6	1.00	10.0
31:2230	4.2	3.0	8.7	1.00	9.3
31:2330	4.1	2.9	8.6	1.00	9.5
32:0030	4.4	2.9	8.5	1.00	9.3
32:0130	4.6	2.9	8.0	1.00	9.5
32:0230	5.0	2.7	8.6	1.00	8.6
32:0330	5.6	2.7	8.6	1.00	8.1
32:0430	5.0	2.7	8.7	1.00	8.1
32:0530	6.1	2.6	8.7	1.00	8.3
32:0630	6.0	2.5	8.6	1.00	8.6
32:0730	5.0	2.4	8.6	1.00	8.6
32:0830	6.0	2.5	8.6	1.00	8.6

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                    APPENDIX B4: TABLE IV.
       RUN 9: DESULPHURISATION PERFORMANCE   PAGE  1 OF 16
           SULPHUR    GAS     O-BED    AIR/    CAO/S
DAY.HOUR   REMOVAL    VEL.    DEPTH    FUEL    RATIO  % CAS   REGEN.
              %       M/S     CENTIM   % ST.   MOL.   TO CAO  S OUT %
                                                              OF FED
 1.1930     86.5     1.47      58.     18.5    0.17    25.5    21.6
 1.2030     85.4     1.20      58.     16.9    0.16    45.6    20.9
 1.2130     87.6     1.25      58.     16.9    0.32     -       0.
          SHUT DOWN AT  1.2130 FOR   4 HOURS
 2.0230     55.4     1.51      53.     22.8    0.      16.8    16.9
 2.0330     59.1     1.62      55.     21.6    1.29    20.2    19.1
 2.0430     59.0     1.63      57.     25.1    2.29    34.1    20.5
 2.0530     73.7     1.66      60.     16.9    1.46    35.1    20.2
 2.0630     75.4     1.54      62.     21.4    1.70    33.6    27.9
 2.0730     74.7     1.54      65.     20.2    1.83    30.8    24.4
 2.0830      -       1.54      63.     19.2    0.25    36.7    30.6
 2.0930      -       1.45      64.     17.9    0.19    62.6    57.3
 2.1030     66.9     1.53      63.     18.3    0.21    67.2    60.7
 2.1130     66.8     1.53      66.     17.4    0.23    62.1    52.6
 2.1230     65.6     1.45      66.     18.1    0.23    63.8    53.2
 2.1330     63.3     1.40      67.     18.1    0.29    62.3    53.8
 2.1430     61.8     1.17      67.     15.8    0.28    61.8    57.7
 2.1530     56.5     1.28      68.     17.4    0.81    70.4    53.1
 2.1630     64.6     1.29      69.     17.4    0.76    59.6    50.2
 2.1730     67.7     1.37      72.     18.7    1.05    55.9    50.5
 2.1830     69.2     1.44      73.     19.8    1.13    55.1    57.7
 2.1930     71.8     1.42      73.     19.3    [illegible]    50.4    50.3
 2.2030     70.8     1.30      76.     19.5    0.61    51.5    60.5
 2.2130     71.2     1.50      76.     21.6    0.85    62.5    62.1
 2.2230     70.6     1.42      77.     19.2    0.71    60.6    65.7
 2.2330     67.2     1.42      77.     19.4    0.88    56.8    64.6
          SHUT DOWN AT  2.2330 FOR  28 HOURS
 4.0430      -       1.51      80.     18.7    0.27     -       7.5
 4.0530      -       1.56      82.     19.8    0.91    52.2    56.7
 4.0630     30.6     1.48      85.     19.7    1.42    57.7    67.3
 4.0730     79.2     1.72      87.     24.8    2.24    50.3    66.3
 4.0830     80.3     1.65      88.     22.8    1.10    50.3    64.6
 4.0930     81.7     1.65      90.     23.8    2.16    52.5    57.8
 5.1030            MISSED DATA READING
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APPENDIX B: TABLE IV.
RUN 9: DESULPHURISATION PERFORMANCE PAGE 2 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	B-BED DEPTH CENTIM	AIR/ FUEL % ST. MIX.	CAO/S RATIO	% CAS TO CAO	RECIRC. S OUT % OF FED
4.1230	74.5	1.88	87.	26.8	0.93	-	0.
4.1330	71.9	2.03	88.	28.8	1.21	-	0.
4.1430	73.4	2.03	84.	28.4	1.43	-	0.
4.1530	75.8	2.06	88.	27.2	0.52	51.6	76.2
4.1630	71.2	2.32	86.	27.9	0.38	54.3	72.6
4.1730	68.8	2.26	90.	27.9	0.45	53.2	65.8
4.1830	69.7	2.09	84.	28.5	1.87	49.2	62.7
4.1930	73.9	2.01	94.	26.8	2.06	47.9	61.3
4.2030	73.4	1.98	92.	26.9	2.78	49.1	54.5
4.2130	75.3	2.03	93.	27.6	1.92	53.4	68.3
4.2230	76.8	2.11	93.	29.5	0.76	51.6	65.8
4.2330	77.3	2.11	100.	29.8	2.78	52.6	54.2
5.0030	76.4	2.14	91.	29.5	1.17	53.9	68.7
5.0130	74.5	2.14	98.	30.1	2.18	57.1	67.6
5.0230	72.7	2.14	91.	31.2	1.55	58.5	71.8
5.0330	74.7	2.09	91.	29.7	1.52	55.2	64.5
5.0430	79.5	2.07	95.	30.4	2.15	58.6	58.7
5.0530	81.1	2.07	95.	30.3	0.98	49.8	63.6
5.0630	77.2	1.93	96.	28.9	2.44	47.4	48.3
5.0730	80.3	1.95	99.	28.7	1.75	48.6	55.4
5.0830	80.5	1.93	99.	29.8	1.65	48.7	53.5
5.0930	81.1	1.93	103.	28.8	1.98	50.8	54.8
5.1030	82.1	2.01	101.	29.1	1.24	49.8	51.9
5.1130	82.2	2.01	102.	29.2	1.99	47.4	51.3
5.1230	82.4	2.03	100.	30.2	1.94	49.6	63.7
5.1330	81.9	2.11	102.	30.3	2.18	58.1	70.6
5.1430	77.8	2.29	96.	31.3	2.11	53.5	73.4
5.1530	79.4	2.22	93.	30.0	1.31	54.2	73.3
5.1630	80.6	2.20	96.	30.1	1.43	53.7	71.5
5.1730	81.4	2.17	99.	30.3	1.73	49.4	61.5
5.1830	76.2	2.18	93.	30.0	1.81	49.7	61.6
5.1930	74.9	2.20	99.	30.1	1.65	49.2	61.0
5.2030	76.8	2.17	100.	29.8	2.61	45.7	52.9
5.2130	80.8	2.12	99.	28.8	3.08	51.6	55.5
5.2230	79.1	2.15	100.	31.8	3.18	50.7	65.6
5.2330	80.7	2.18	99.	31.2	1.54	50.3	66.6
6.0030	83.2	2.17	99.	31.2	3.57	45.6	61.4
6.0130	82.1	2.18	99.	31.3	2.73	45.6	68.7
6.0230	82.3	2.18	98.	31.3	3.27	45.8	68.9
6.0330	82.3	2.18	99.	31.8	3.31	42.6	56.7

APPENDIX B. TABLE IV.
RUN 9: DESULPHURISATION PERFORMANCE PAGE 3 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	B=BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
6.0430	82.4	2.09	99.	30.9	3.42	41.7	54.6
6.0530	83.5	2.11	95.	30.0	3.72	41.7	56.6
6.0630	85.2	2.09	96.	30.6	3.99	41.7	57.3
6.0730	86.7	2.12	93.	31.5	3.79	42.6	59.6
6.0830	85.9	2.11	87.	30.9	4.51	41.6	57.4
6.0930	87.4	2.26	92.	32.1	3.52	50.2	71.7
6.1030	-	2.20	91.	32.1	3.83	44.2	63.4
6.1130	79.4	2.11	98.	30.2	3.11	39.5	58.3
6.1230	81.8	2.09	98.	30.6	5.13	39.7	59.8
6.1330	84.1	2.14	87.	29.2	3.65	43.3	64.5
6.1430	83.8	2.20	89.	31.8	4.24	42.2	71.2
6.1530	84.9	2.04	98.	28.6	2.55	36.4	49.8
6.1630	85.9	2.04	82.	28.9	1.87	48.0	62.2
6.1730	83.8	2.04	82.	27.1	2.62	-	0.
6.1830	84.8	2.01	82.	28.2	1.83	-	0.
6.1930	80.6	1.75	98.	25.5	0.	-	0.
6.2030	78.5	1.87	77.	26.9	0.	-	0.

SHUT DOWN AT 6.2030 FOR 4 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	B=BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
7.0130	-	1.34	71.	20.8	0.	78.7	55.6
7.0230	77.7	1.75	78.	25.7	0.86	67.7	85.2
7.0330	80.5	1.70	82.	26.8	0.83	58.9	86.3
7.0430	75.8	1.63	82.	25.8	0.89	58.2	84.5
7.0530	76.1	1.73	83.	25.9	1.33	55.2	74.4
7.0630	79.4	1.67	83.	24.9	0.89	57.2	73.5
7.0730	79.5	1.59	83.	23.9	0.89	55.2	69.7
7.0830	78.8	1.65	83.	24.9	1.24	56.6	68.2
7.0930	79.6	1.65	85.	26.8	1.81	63.4	69.6
7.1030	78.5	1.53	85.	23.6	0.49	63.0	65.2
7.1130	78.9	1.59	86.	24.2	0.38	64.7	63.1
7.1230	77.3	1.59	86.	23.6	0.41	68.9	61.1
7.1330	76.5	1.59	87.	24.2	0.98	58.7	59.9
7.1430	77.6	1.56	88.	23.8	1.28	60.4	57.2
7.1530	76.4	1.61	90.	24.8	5.23	57.3	42.5
7.1630	78.1	1.62	96.	25.1	3.96	62.9	56.6
7.1730	86.3	1.53	102.	25.3	3.92	64.8	56.6
7.1830	80.8	1.61	109.	26.7	3.47	66.7	57.4
7.1930	87.8	1.59	111.	27.2	2.36	76.4	65.9

APPENDIX G. TABLE IV.

RUN 9: DESULPHURISATION PERFORMANCE PAGE 4 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST. MOL.	CAO/S RATIO	% CAS TO CAO	RECRN. % OUT % OF FED
7.2030	-	1.62	114.	27.7	0.31	55.1	47.4
7.2130	-	1.72	109.	27.6	1.48	50.6	95.4
7.2230	92.5	1.73	109.	26.3	1.45	57.5	96.7
7.2330	88.4	1.67	109.	26.1	1.53	55.8	91.8
8.0030	88.4	1.67	109.	27.3	1.88	55.7	99.7
8.0130	88.8	1.67	109.	27.6	1.36	56.3	94.6
8.0230	88.9	1.67	109.	26.6	1.25	56.6	81.4
8.0330	88.3	1.73	111.	26.3	1.47	57.5	80.3
8.0430	88.6	1.67	118.	26.3	1.80	57.8	81.3
8.0530	88.3	1.66	118.	26.3	1.87	58.8	70.8
8.0630	88.3	1.65	118.	26.3	1.36	57.9	80.8
8.0730	87.7	1.72	118.	26.7	1.27	56.9	98.8
8.0830	86.6	1.72	111.	27.9	1.52	52.9	70.1
8.0930	87.2	1.72	114.	26.7	1.81	54.7	81.3
8.1030	87.2	1.72	114.	26.5	1.20	53.7	76.7
8.1130	88.8	1.68	115.	27.8	2.11	54.8	82.4
8.1230	-	1.70	115.	26.6	2.03	53.2	84.8
8.1330	88.0	1.70	115.	25.5	1.08	52.7	74.2
8.1430	89.1	1.68	118.	26.8	1.07	54.4	88.5
8.1530	88.6	1.58	118.	25.8	1.35	62.3	83.4
8.1630	86.8	1.64	120.	25.1	1.66	46.1	41.7
8.1730	87.1	1.72	118.	27.1	1.29	64.1	81.4
8.1830	88.1	1.64	119.	25.6	1.60	50.9	62.7
8.1930	88.1	1.70	118.	27.4	1.71	60.5	76.7
8.2030	91.2	1.70	118.	26.9	1.31	59.9	78.4
8.2130	92.6	1.64	118.	26.9	1.59	58.5	77.4

SHUT DOWN AT 8.2130 FOR 8 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST. MOL.	CAO/S RATIO	% CAS TO CAO	RECRN. % OUT % OF FED
9.0630	82.5	1.64	122.	25.7	0.76	49.8	76.1
9.0730	83.3	1.59	134.	24.7	0.79	51.0	81.4
9.0830	83.1	1.71	111.	26.6	0.53	64.4	75.8
9.0930	84.2	1.72	109.	26.7	1.02	65.4	75.7
9.1030	86.8	1.72	109.	26.7	1.58	58.4	81.5
9.1130	85.8	1.72	111.	26.7	0.99	60.0	90.7
9.1230	-	1.73	118.	26.7	0.99	58.7	72.8
9.1330	85.8	1.73	118.	26.5	1.37	59.8	75.1
9.1430	85.9	1.73	108.	26.8	1.62	59.6	81.2
9.1530	86.1	1.72	104.	26.6	2.28	57.6	77.5

APPENDIX 6. TABLE IV.
RUN 9: DESULPHURISATION PERFORMANCE PAGE 5 OF 10

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
9.1630	85.2	1.73	106.	26.6	1.76	57.3	88.4
9.1730	86.4	1.73	106.	27.3	1.14	56.2	79.6
9.1830	87.1	1.72	107.	27.6	1.03	55.8	73.1
9.1930	87.4	1.72	109.	27.6	1.77	56.2	75.2
9.2030	87.5	1.72	111.	25.9	1.42	55.6	78.6

SHUT DOWN AT 9.2030 FOR 5 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
10.0230	-	1.59	111.	25.7	0.46	-	0.
10.0330	84.0	1.62	111.	25.6	0.56	55.3	71.6
10.0430	82.3	1.67	111.	26.1	0.63	60.8	71.8
10.0530	84.4	1.72	113.	27.1	1.30	61.7	74.1
10.0630	86.4	1.65	115.	26.0	2.02	59.6	77.6
10.0730	87.0	1.65	115.	25.9	0.84	61.4	82.0
10.0830	87.2	1.65	115.	26.6	1.02	60.6	78.7
10.0930	87.5	1.73	118.	26.6	1.26	53.8	54.1
10.1030	87.7	1.72	116.	27.5	1.32	60.6	54.3
10.1130	88.2	1.65	116.	26.1	1.33	56.4	83.5
10.1230	86.2	1.65	116.	26.2	1.30	60.4	82.5
10.1330	86.3	1.65	116.	25.8	1.12	62.3	87.5
10.1430	86.3	1.65	116.	26.3	1.31	65.5	86.4
10.1530	86.1	1.65	116.	25.6	1.05	68.1	74.0
10.1630	86.2	1.65	116.	26.3	1.14	66.7	81.4
10.1730	86.8	1.64	110.	26.4	1.42	61.6	81.1
10.1830	86.8	1.65	116.	25.7	1.16	64.8	83.7
10.1930	86.1	1.65	116.	26.2	0.84	66.2	86.8
10.2030	85.5	1.59	116.	25.8	0.73	66.5	83.9
10.2130	85.6	1.59	110.	24.3	1.36	64.2	70.1
10.2230	85.8	1.22	110.	26.2	1.03	64.4	81.1
10.2330	85.2	1.65	110.	26.2	1.10	60.4	83.2
11.0030	85.5	1.64	110.	26.2	1.03	58.7	88.9
11.0130	85.2	1.58	116.	25.5	1.24	59.2	81.7
11.0230	85.6	1.65	114.	26.1	1.86	67.0	88.2
11.0330	-	1.67	114.	26.1	1.88	65.3	77.8
11.0430	84.3	2.30	111.	37.1	1.16	72.1	83.6
11.0530	82.8	1.50	114.	25.3	1.84	68.0	81.3
11.0630	81.8	1.61	115.	25.1	0.77	41.5	36.2
11.0730	80.2	1.59	110.	25.2	2.84	63.4	56.0
11.0830	82.6	1.67	118.	26.3	1.87	61.6	43.6

APPENDIX 6.4 TABLE IV.
RUN 9: DESULPHURISATION PERFORMANCE PAGE 6 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
11.0030	84.5	1.67	116.	26.0	1.56	65.9	64.9
11.1030	85.1	1.65	115.	26.1	1.20	71.6	90.6
11.1130	86.2	1.60	114.	25.9	1.40	77.2	99.1
11.1230	86.1	1.65	111.	25.9	1.33	70.4	91.3
11.1330	86.1	1.65	113.	25.8	0.99	66.9	97.7
11.1430	85.6	1.65	115.	26.6	1.26	69.8	75.7
11.1530	86.3	1.65	116.	26.0	1.26	62.0	77.7
11.1630	84.7	1.51	116.	24.5	1.23	67.3	79.1
11.1730	83.9	1.51	118.	24.5	1.51	64.9	72.7
11.1830	83.6	1.51	116.	23.9	1.20	57.3	66.2
11.1930	84.5	1.51	116.	23.8	1.29	59.1	68.4
11.2030	85.8	1.64	116.	25.8	1.29	57.3	73.0
11.2130	85.7	1.65	116.	26.8	1.31	55.6	69.0
11.2230	85.4	1.72	116.	26.0	1.00	57.2	71.3
11.2330	85.4	1.75	111.	27.2	0.73	57.7	73.5
12.0030	83.9	1.47	111.	24.0	1.51	58.7	76.3
12.0130	85.7	1.47	118.	25.9	1.70	64.8	82.0
12.0230	85.4	1.47	118.	26.6	1.23	64.5	70.7
12.0330	84.6	1.48	119.	24.7	1.26	73.9	78.3
12.0430	83.4	1.48	119.	24.8	1.27	58.8	39.8
12.0530	82.4	1.48	119.	25.9	1.15	53.9	42.7
12.0630	85.7	1.48	119.	25.0	1.04	70.6	64.9
12.0730	87.7	1.48	119.	25.9	0.86	71.4	85.3
12.0830	-	1.54	118.	27.8	0.78	60.0	87.1
12.0930	-	1.54	119.	27.0	0.80	65.9	84.0
12.1030	85.5	1.54	118.	27.8	0.86	64.3	83.2
12.1130	86.0	1.56	119.	27.2	0.49	65.3	81.2
12.1230	85.5	1.56	118.	26.7	0.29	65.8	94.3
12.1330	84.8	1.61	119.	27.6	0.59	58.2	94.9
12.1430	84.6	1.53	120.	25.9	0.58	58.9	86.0
12.1530	84.1	1.53	120.	25.8	0.58	60.8	83.5
12.1630	84.1	1.53	120.	25.6	0.57	63.1	76.4
12.1730	84.1	1.53	120.	25.7	0.43	63.6	75.7
12.1830	83.7	1.53	119.	25.6	0.36	61.8	75.5
12.1930	83.4	1.53	119.	25.5	0.32	62.6	74.6
12.2030	83.9	1.51	119.	25.5	0.14	62.9	74.0
12.2130	82.4	1.53	119.	25.3	0.04	63.4	78.2
12.2230	81.1	1.53	119.	25.7	0.57	61.1	75.1
12.2330	80.2	1.53	120.	25.8	0.54	62.2	74.2
13.0030	80.8	1.51	120.	25.3	0.64	61.9	72.6

APPENDIX G: TABLE IV.

RUN 6: DESULPHURISATION PERFORMANCE PAGE 7 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	B-BED DEPTH CENTIM	AIR/ FUEL % ST. MOL.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
13.0130	80.1	1.53	120.	25.0	0.39	63.5	67.7
13.0230	80.4	1.53	121.	25.7	0.03	66.9	65.9
13.0330	79.6	1.53	121.	26.7	0.14	66.5	66.2
13.0430	79.1	1.51	122.	26.2	1.03	44.9	34.2
13.0530	78.4	1.51	123.	26.4	0.46	42.9	36.6
13.0630	75.8	1.53	123.	26.5	0.43	38.1	33.6
13.0730	75.5	1.50	120.	27.4	0.37	47.2	73.5
13.0830	77.5	1.54	120.	26.1	0.32	47.9	45.6
13.0930	77.3	1.48	119.	24.3	0.36	46.8	39.8
13.1030	77.2	1.50	120.	25.8	0.29	60.1	15.9
13.1130	77.1	1.48	119.	26.5	0.55	67.1	66.2

SHUT DOWN AT 13.1130 FOR 13 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	B-BED DEPTH CENTIM	AIR/ FUEL % ST. MOL.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
14.0130	71.9	1.53	102.	25.4	1.36	56.8	78.2
14.0230	79.5	1.51	105.	24.9	1.16	62.3	89.9
14.0330	77.4	1.50	107.	27.2	2.03	65.3	67.6
14.0430	78.8	1.51	110.	24.7	0.97	78.6	61.6
14.0530	77.7	1.51	111.	24.6	0.88	61.5	41.9
14.0630	79.6	1.44	113.	24.8	1.35	65.8	40.3
14.0730	78.3	1.44	115.	24.9	1.44	61.8	29.6
14.0830	79.4	1.51	119.	27.7	1.37	62.8	42.9
14.0930	77.9	1.53	118.	27.2	0.76	43.3	23.4
14.1030	78.7	1.53	123.	26.1	0.44	5.8	4.4
14.1130	80.2	1.54	120.	26.1	0.47	8.0	11.6
14.1230	81.3	1.70	116.	28.5	0.51	30.6	40.2
14.1330	80.6	1.70	111.	28.9	0.63	75.9	115.8
14.1430	78.5	1.64	111.	27.8	0.41	68.6	96.8
14.1530	78.2	1.60	112.	27.4	0.40	91.5	94.8
14.1630	78.8	1.51	113.	26.9	0.47	71.9	91.8
14.1730	78.8	1.59	105.	26.4	0.67	66.5	83.1
14.1830	77.2	1.53	106.	25.6	0.71	93.4	86.2
14.1930	79.2	1.59	107.	25.8	0.73	74.9	88.8
14.2030	80.3	1.73	106.	25.5	0.81	64.5	81.3
14.2130	81.8	1.72	109.	25.1	0.65	63.8	79.7
14.2230	-	1.72	111.	25.1	0.68	63.1	77.8
14.2330	79.1	1.72	116.	26.2	0.68	63.5	82.9
15.0030	77.9	1.67	118.	26.4	0.78	65.1	79.8
15.0130	78.4	1.67	118.	24.9	0.75	64.6	71.8

APPENDIX G. TABLE IV.

RUN 91 DESULPHURIZATION PERFORMANCE PAGE 8 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
15.0230	78.2	1.70	111.	26.9	0.74	66.2	74.2
15.0330	78.4	1.67	111.	27.0	0.48	61.4	71.8
15.0430	79.2	1.90	113.	27.5	0.48	59.8	79.5
15.0530	79.2	1.92	110.	27.5	0.36	62.6	67.3
15.0630	79.7	1.93	115.	26.2	0.37	61.8	74.6
15.0730	73.4	1.66	118.	27.5	0.26	61.8	73.8
15.0830	79.8	1.67	109.	26.2	0.68	60.5	66.3
15.0930	79.3	1.79	111.	26.6	0.68	56.8	74.6
15.1030	79.8	1.79	111.	27.6	0.76	60.9	69.8
15.1130	79.1	1.83	111.	27.9	0.51	57.9	77.2
15.1230	79.3	1.90	111.	28.3	0.40	54.6	69.6
15.1330	78.4	1.64	111.	28.6	0.50	57.8	73.9
15.1430	77.1	1.58	111.	27.7	0.40	58.2	73.9
15.1530	78.1	1.64	111.	26.9	0.52	60.1	79.3
15.1630	77.9	1.58	111.	27.7	0.56	63.6	72.4
SHUT DOWN AT 15.1630 FOR 14 HOURS							
16.0730	75.4	1.61	95.	28.5	1.63	63.5	88.1
16.0830	76.8	1.70	97.	28.8	1.43	74.1	86.5
16.0930	77.6	1.86	99.	28.9	1.52	56.9	87.7
16.1030	88.8	1.95	101.	29.9	1.70	73.1	88.9
16.1130	88.5	2.37	102.	30.7	1.11	59.5	88.5
16.1230	-	2.27	102.	30.3	0.52	56.4	95.6
16.1330	75.7	2.37	101.	30.2	0.56	54.8	91.2
16.1430	74.7	2.30	100.	29.9	0.44	52.7	87.8
16.1530	74.4	2.37	101.	30.6	0.48	51.1	85.5
16.1630	MISSED DATA READING						
16.1730	69.8	1.56	97.	25.7	0.27	5.8	7.2
16.1830	74.4	1.59	101.	26.8	2.25	47.6	69.5
16.1930	76.2	1.53	101.	29.6	0.67	49.1	90.3
16.2030	73.6	2.34	101.	29.8	0.58	47.9	84.5
16.2130	72.7	2.23	101.	28.4	0.58	44.2	81.9
16.2230	72.7	2.22	101.	29.6	0.38	43.3	77.9
16.2330	74.8	2.36	101.	29.6	0.42	45.2	70.8
17.0030	MISSED DATA READING						
17.0130	MISSED DATA READING						
17.0330	67.7	2.26	99.	35.8	0.64	51.7	79.8
17.0430	64.7	2.26	100.	26.8	0.46	40.9	63.6

APPENDIX 9: TABLE IV.

RUN 9: DESULPHURISATION PERFORMANCE PAGE 9 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
17.0530	63.6	2.23	99.	26.2	0.45	49.3	54.6
17.0630	68.7	2.26	101.	25.7	0.45	52.2	57.7
17.0730	69.4	2.23	100.	25.5	0.38	48.6	51.6
17.0830	67.8	2.20	99.	25.9	0.35	51.4	54.3
17.0930	68.7	2.25	99.	27.5	0.40	53.6	54.6
17.1030	70.3	2.36	99.	26.1	0.50	52.5	47.9
17.1130	70.3	2.26	99.	27.7	0.56	49.8	60.2
17.1230	68.4	2.29	100.	26.9	0.51	44.2	67.3
17.1330	70.2	2.26	100.	27.2	0.39	52.3	68.2
17.1430	71.9	2.15	85.	26.9	0.42	52.4	66.1
17.1530	70.4	2.25	95.	26.7	0.35	52.4	68.6
17.1630	68.7	2.34	92.	27.7	0.29	47.6	62.9
17.1730	68.2	2.15	97.	27.6	3.54	43.8	56.9
17.1830	70.9	1.99	96.	22.1	0.56	50.2	60.0
17.1930	74.2	1.98	93.	21.9	0.88	61.0	60.6
17.2030	73.6	1.97	91.	22.6	0.44	62.5	72.5
17.2130	70.4	2.11	99.	30.4	0.57	58.2	73.0
17.2230	70.3	1.97	99.	24.5	0.54	64.6	66.6
17.2330	71.8	1.97	99.	24.6	0.54	68.3	61.0
18.0030	72.0	1.96	99.	24.6	0.57	68.3	66.1
18.0130	71.2	1.96	99.	25.7	0.45	66.5	59.1
18.0230	71.3	1.98	99.	24.7	0.44	74.8	62.8
18.0330	71.6	1.81	100.	23.7	0.64	71.8	58.5
18.0430	-	1.81	100.	23.1	0.55	71.8	50.0
18.0530	70.8	1.83	100.	23.0	0.40	74.1	50.8
18.0630	71.4	1.89	101.	23.8	0.46	68.4	41.6
18.0730	71.5	2.03	101.	26.3	0.50	44.0	26.4
18.0830	72.0	1.98	102.	24.7	0.46	55.2	36.7
18.0930	73.8	1.97	102.	26.6	0.38	54.2	36.1
18.1030	-	2.03	101.	26.2	0.39	51.2	31.8
18.1130	73.2	2.03	104.	27.4	0.53	66.7	61.8
18.1230	71.7	1.99	104.	27.1	0.56	57.9	39.8
18.1330	69.8	1.65	104.	28.0	0.41	17.2	9.6
18.1430	69.5	1.70	104.	23.9	0.32	61.5	46.9
18.1530	70.1	1.64	101.	25.1	0.43	45.1	35.4
18.1630	70.2	1.59	109.	24.1	0.48	42.6	38.3
18.1730	70.5	1.59	110.	24.8	0.46	30.0	37.8
18.1830	69.3	1.75	106.	22.8	0.88	49.9	53.1
18.1930	71.6	1.88	107.	23.3	0.71	50.1	74.1
18.2030	73.6	1.86	107.	26.5	0.88	65.0	100.2

APPENDIX G. TABLE IV.
RUN 91 DESULPHURISATION PERFORMANCE PAGE 10 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/ FUEL % ST.	CA/S RATIO MOL.	% CAS TO CAO	REGEN. % OUT % OF FED
18.2130	76.8	1.75	106.	24.9	0.08	70.5	134.3
18.2230	76.5	1.75	105.	26.4	0.47	71.3	71.5
18.2330	72.8	1.80	104.	27.5	0.47	65.3	65.8
19.0030	71.5	1.68	101.	25.1	0.68	64.8	65.2
19.0130	71.6	1.61	99.	30.6	0.93	22.5	28.9
19.0230	71.3	1.70	96.	26.8	0.78	62.9	87.8
19.0330	69.9	1.76	96.	25.4	0.56	58.2	89.3
19.0430	68.8	1.79	93.	25.9	0.40	59.7	73.6
19.0530	68.3	1.78	95.	26.8	0.28	61.3	75.4
19.0630	65.5	1.76	92.	28.4	0.32	60.3	70.1
19.0730	62.4	1.79	93.	26.6	0.43	56.6	65.5
19.0830	64.4	1.61	91.	25.4	0.54	57.3	65.4
19.0930	65.2	1.83	92.	30.2	1.80	63.9	58.8
19.1030	-	1.67	95.	27.9	1.44	58.9	60.8
19.1130	80.3	1.69	96.	27.5	1.46	56.1	61.4
19.1230	79.3	1.59	96.	28.2	2.13	55.1	58.9
19.1330	80.8	1.61	96.	27.4	1.27	57.5	61.8
19.1430	MISSED DATA READING						
19.1530	81.4	1.58	101.	27.0	2.09	55.0	65.6
19.1630	83.3	1.65	104.	27.9	1.58	49.9	62.3
19.1730	84.7	1.64	105.	27.9	2.18	46.1	68.8
19.1830	84.6	1.72	104.	29.7	1.28	43.6	60.6
19.1930	84.4	1.66	105.	28.7	1.40	45.3	60.9
19.2030	85.4	1.72	107.	29.3	2.12	44.2	60.1
19.2130	85.7	1.65	106.	27.8	1.93	49.4	65.3
19.2230	85.6	1.67	104.	28.6	1.20	51.7	65.5
STONE CHANGE							
19.2330	83.8	1.73	105.	29.1	1.74	50.5	64.4
20.0030	88.5	1.65	106.	28.1	1.71	48.6	62.1
20.0130	89.1	1.66	107.	27.9	1.40	49.8	61.8
20.0230	89.5	1.66	109.	28.1	1.20	49.5	62.1
20.0330	88.4	1.69	109.	28.6	1.12	51.8	62.2
20.0430	88.4	1.67	109.	28.1	0.87	55.4	63.4
20.0530	88.1	1.69	107.	28.6	0.47	54.2	60.5
20.0630	87.7	1.67	106.	28.8	0.87	50.5	62.7
20.0730	87.4	1.67	106.	28.6	0.83	53.1	62.1
20.0830	87.2	1.67	102.	28.2	0.87	54.6	65.7
STONE CHANGE							
20.0930	86.7	1.67	109.	28.2	0.72	52.8	63.5
20.1030	86.3	1.61	107.	26.3	0.66	52.4	61.6

APPENDIX G1 TABLE IV.

RUN 91 DESULPHURISATION PERFORMANCE PAGE 11 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	B-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
20.1130	84.8	1.62	104.	27.2	0.62	51.4	72.4
20.1230	70.7	1.62	108.	27.2	0.50	40.8	69.1
20.1330	78.8	1.60	99.	28.1	0.90	44.9	65.7
20.1430	–	1.59	100.	26.9	1.42	43.8	65.1
20.1530	86.2	1.61	99.	27.4	1.40	43.7	69.1
20.1630	76.6	1.61	99.	27.1	1.15	42.7	67.4
20.1730	83.2	1.59	99.	27.1	1.12	43.6	81.2
20.1830	85.8	1.59	99.	27.1	1.44	42.6	80.8
20.1930	85.4	1.62	99.	27.8	2.40	46.6	63.1
20.2030	81.8	1.62	98.	27.8	0.	45.4	60.2

SHUT DOWN AT 20.2030 FOR 35 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	B-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
22.0830	67.8	2.17	95.	41.3	5.11	26.4	31.6
22.0930	MISSED DATA READING						
22.1030	76.9	2.15	87.	33.8	3.46	34.8	40.8
22.1130	82.1	1.84	98.	30.2	1.07	9.4	11.2
22.1230	82.0	1.78	91.	28.1	2.10	42.8	84.0
22.1330	81.9	1.73	96.	29.7	2.16	43.7	65.1
22.1430	83.7	1.68	99.	29.6	2.46	47.8	63.1
22.1530	82.6	1.70	101.	28.9	1.54	51.6	66.4
22.1630	83.3	1.70	104.	30.3	1.76	56.9	76.2
22.1730	82.8	1.68	104.	31.5	1.77	47.8	65.2
22.1830	82.7	1.56	103.	25.4	1.69	53.3	63.3
22.1930	84.4	1.51	109.	27.3	1.62	52.6	92.8
22.2030	84.3	1.53	109.	27.2	1.38	66.6	78.6
22.2130	83.4	1.53	109.	30.4	1.58	54.8	76.7
22.2230	84.2	1.54	111.	31.6	1.78	48.9	78.6
22.2330	85.1	1.56	111.	32.1	1.62	56.5	86.1
23.0030	84.9	1.64	113.	34.2	1.84	58.8	81.7
23.0130	84.5	1.64	113.	34.7	1.82	43.9	88.5
23.0230	83.8	1.66	111.	35.6	1.46	52.8	82.5
23.0330	81.9	1.73	118.	37.2	1.73	49.9	79.7
23.0430	88.3	1.73	111.	37.6	1.82	63.1	84.4
23.0530	78.8	1.67	111.	35.6	1.68	46.2	72.9
23.0630	77.3	1.62	107.	33.6	2.87	43.5	66.6
23.0730	77.8	1.70	107.	34.5	1.53	58.2	75.2
23.0830	79.8	1.62	109.	35.5	2.86	65.8	97.3
23.0930	78.9	1.78	104.	36.8	3.11	55.4	84.9

APPENDIX A, TABLE IV.

RUN 91 DESULPHURIZATION PERFORMANCE PAGE 12 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	G-BED DEPTH CENTIM	AIR/FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. % OUT % OF FED
23.1030	78.3	1.67	181.	33.2	2.29	7.5	7.8
23.1130	79.0	1.65	184.	30.4	1.79	40.8	46.9
23.1230	78.0	1.45	184.	35.0	1.76	55.6	61.8
23.1330	79.4	1.50	99.	29.8	1.25	30.7	39.0
23.1430	74.8	1.50	96.	27.5	1.33	66.5	61.7
23.1530	77.0	1.50	180.	32.3	1.33	49.0	35.4
23.1630	77.0	1.58	182.	32.4	1.33	68.0	87.8
23.1730	78.9	1.58	181.	25.5	1.28	59.3	70.7
23.1830	74.8	1.50	81.	30.5	1.16	61.7	64.5
23.1930	72.8	1.50	88.	25.5	1.19	43.7	58.2
23.2030	73.4	1.20	96.	31.2	1.27	64.1	72.6
23.2130	67.3	1.31	88.	22.8	1.21	29.7	23.1
23.2230	64.0	1.45	75.	33.5	0.56	91.8	5.6
23.2330	61.4	1.58	79.	25.7	1.07	-	0.
24.0030	63.7	1.65	82.	28.0	1.15	-	0.
24.0130	66.6	1.75	102.	29.7	0.84	-	0.
24.0230	68.8	1.70	104.	29.8	0.61	-	0.
24.0330	70.1	1.62	105.	27.5	0.72	4.5	3.7
24.0430	71.8	1.70	106.	29.0	0.61	6.8	3.6
24.0530	-	1.70	105.	30.0	0.62	12.2	7.4
24.0630	71.2	1.61	104.	30.0	0.65	46.1	38.3
24.0730	73.0	1.61	102.	30.8	0.51	73.5	76.2
24.0830	76.2	1.61	101.	30.0	0.65	82.7	102.6
24.0930	78.8	1.50	102.	30.0	1.67	65.8	48.5
24.1030	74.8	1.53	105.	30.3	2.46	86.8	107.3
24.1130	78.8	1.50	109.	30.8	2.48	78.0	110.0
24.1230	80.6	1.50	110.	30.7	2.38	76.6	113.8
24.1330	83.1	1.58	111.	30.8	2.80	81.1	122.9
24.1430	83.2	1.50	111.	30.8	2.85	70.5	110.7
24.1530	83.5	1.58	113.	30.0	2.82	75.3	107.0
24.1630	83.6	1.51	113.	30.5	1.84	73.3	107.5
24.1730	83.4	1.51	114.	29.0	1.75	78.4	104.1
24.1830	83.1	1.51	114.	30.6	1.38	68.7	103.0
24.1930	87.0	1.45	114.	28.2	1.32	61.1	88.9
24.2030	-	1.44	114.	28.3	1.63	58.0	72.8
24.2130	-	1.44	116.	28.4	1.46	42.6	58.2
24.2230	82.5	1.58	116.	30.5	1.35	44.1	60.7
24.2330	82.5	1.50	113.	30.0	1.71	68.1	102.6
25.0030	83.1	1.58	113.	31.1	1.94	64.7	95.8
25.0130	82.4	1.58	114.	30.7	1.53	63.6	92.7

APPENDIX D: TABLE IV.
RUN 9: DESULPHURISATION PERFORMANCE PAGE 13 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS. TO CAO	REGEN. % OUT % OF FED
25.0230	82.8	1.56	118.	30.7	1.06	61.2	88.9
25.0330	83.8	1.56	119.	31.0	1.08	31.3	37.0
25.0430	82.5	1.58	121.	29.8	0.70	78.7	97.6
25.0530	82.4	1.58	120.	31.9	0.44	56.0	71.2
25.0630	81.1	1.65	120.	29.8	0.37	70.2	89.6
25.0730	78.6	1.59	120.	31.5	0.44	62.4	41.7
25.0830	79.9	1.61	119.	31.2	0.56	6.7	7.7

SHUT DOWN AT 25.0830 FOR 6 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS. TO CAO	REGEN. % OUT % OF FED
25.1430	79.3	1.44	120.	30.5	0.28	89.4	58.8
25.1530	76.8	1.44	116.	30.5	1.61	88.9	78.8

SHUT DOWN AT 25.1530 FOR 7 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS. TO CAO	REGEN. % OUT % OF FED
25.2230	78.6	1.73	109.	31.3	0.40	84.1	71.7
25.2330	73.8	1.76	109.	31.2	0.92	80.1	60.1
26.0030	73.4	1.76	107.	33.8	0.88	88.9	61.7
26.0130	75.1	1.56	107.	27.5	1.07	28.3	29.3
26.0230	75.4	1.64	109.	29.9	1.07	31.4	30.7
26.0330	76.8	1.64	118.	26.5	1.06	33.2	38.6
26.0430	76.1	1.64	118.	28.4	0.98	16.7	14.4
26.0530	75.3	1.67	118.	31.3	0.75	76.1	75.7
26.0630	74.9	1.65	118.	29.2	1.13	77.7	76.7
26.0730	74.8	1.66	111.	31.1	1.28	74.1	72.9
26.0830	74.3	1.45	111.	26.6	0.36	73.7	72.3

SHUT DOWN AT 26.0830 FOR 14 HOURS

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS. TO CAO	REGEN. % OUT % OF FED
26.2230	75.1	1.62	93.	31.9	4.05	30.3	57.4
26.2330	79.3	1.64	93.	31.2	4.43	35.7	62.9
27.0030	84.5	1.62	104.	31.2	4.15	-	0.
27.0130	84.7	1.65	106.	31.2	2.83	55.6	99.6
27.0230	84.2	1.65	106.	31.1	3.80	56.6	114.7
27.0330	86.9	1.72	109.	30.7	2.81	53.9	100.8
27.0430	87.7	1.65	118.	31.5	1.77	61.7	105.8
27.0530	88.4	1.70	111.	34.5	2.17	53.8	99.8

APPENDIX G. TABLE IV.

RUN 9: DESULPHURIZATION PERFORMANCE PAGE 14 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. S OUT % OF FED
27.0630	88.1	1.75	113.	33.6	1.69	57.7	104.8
27.0730	87.8	1.76	111.	30.6	0.68	62.7	106.1
27.0830	84.3	1.65	109.	30.3	0.64	-	0.
27.0930	83.3	1.64	109.	32.5	0.74	55.8	108.5
27.1030	83.6	1.50	110.	28.7	0.77	53.2	104.6
27.1130	-	1.51	109.	28.8	0.93	47.3	91.6
27.1230	88.4	1.51	109.	27.9	1.89	54.7	107.7
27.1330	83.1	1.46	108.	26.6	0.64	67.6	141.3
27.1430	88.3	1.46	107.	26.7	0.61	57.5	98.9
27.1530	82.8	1.55	110.	29.3	1.74	57.9	107.8
27.1630	86.5	1.50	110.	29.2	1.61	54.4	109.5
27.1730	85.6	1.50	111.	29.3	0.65	54.6	101.5
27.1830	85.1	1.50	110.	29.2	0.65	54.6	101.1
27.1930	83.7	1.50	110.	29.2	0.61	56.4	106.9
27.2030	82.5	1.50	110.	28.1	1.61	55.6	106.9
27.2130	80.7	1.44	113.	25.3	1.19	53.1	103.8
27.2230	81.8	1.42	114.	26.9	0.97	51.4	99.8
27.2330	82.7	1.58	114.	30.4	0.94	51.7	96.6
28.0030	81.8	1.58	111.	29.1	0.92	50.7	96.5
28.0130	81.5	1.56	111.	29.5	1.14	60.2	94.2
28.0230	84.2	1.48	114.	28.2	1.50	48.0	89.1
28.0330	85.8	1.30	114.	25.4	1.38	51.3	97.4
28.0430	87.5	1.47	116.	27.1	1.38	52.8	83.4
28.0530	87.4	1.42	118.	27.3	1.65	50.4	89.9
28.0630	86.7	1.42	116.	26.6	1.61	54.8	80.6
28.0730	85.1	1.50	116.	28.7	1.28	53.9	97.8
28.0830	85.2	1.42	116.	28.2	1.26	54.2	97.3
28.0930	85.7	1.42	118.	26.4	1.32	52.9	92.8
28.1030	86.8	1.42	119.	26.9	1.13	56.2	96.7
28.1130	86.3	1.40	119.	26.9	1.18	50.2	99.2
28.1230	86.3	1.42	119.	26.9	1.13	56.8	97.8
28.1330	85.9	1.47	119.	26.7	1.18	53.2	94.9
28.1430	84.5	1.44	123.	26.7	0.98	57.7	80.9
28.1530	84.8	1.47	123.	24.8	1.42	55.6	72.8
28.1630	-	1.46	118.	25.8	0.97	53.1	86.8
28.1730	88.7	1.48	119.	24.9	0.19	45.7	83.9
28.1830	89.5	1.42	118.	23.8	0.57	40.9	92.6
28.1930	89.1	1.44	113.	23.8	0.	54.4	96.7
28.2030	89.1	1.50	111.	24.8	0.	56.9	94.9
28.2130	89.8	1.44	104.	23.5	0.	60.3	98.2

APPENDIX G. TABLE IV.

RUN 91 DESULPHURISATION PERFORMANCE PAGE 15 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	S-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	SULPH. S OUT % OF FED
28.2230	87.4	1.31	104.	22.6	0.36	46.0	42.[illegible]
SHUT DOWN AT 28.2230 FOR 24 HOURS							
29.2330	–	2.01	72.	23.8	0.	36.7	41.0
30.0030	57.9	2.14	73.	25.7	1.48	44.3	51.4
30.0130	62.8	2.25	76.	26.6	1.21	46.6	64.1
30.0230	MISSED DATA READING						
30.0330	MISSED DATA READING						
30.0430	54.5	2.04	73.	22.9	0.58	40.5	45.7
30.0530	54.2	2.11	76.	21.7	1.38	41.1	47.0
30.0630	66.3	1.42	77.	23.3	1.00	40.9	57.4
30.0730	76.1	1.34	82.	22.6	2.[illegible]	44.8	56.4
30.0830	83.6	1.29	85.	23.5	2.10	43.7	65.5
30.0930	–	1.30	86.	24.9	1.88	45.1	62.3
30.1030	87.7	1.33	88.	24.5	0.81	53.0	57.7
30.1130	86.3	1.33	88.	23.3	0.77	51.0	62.0
30.1230	85.2	1.34	88.	24.3	1.00	53.6	66.4
30.1330	83.8	1.34	86.	23.9	1.03	56.3	71.8
30.1430	82.9	1.34	85.	24.1	0.84	55.2	73.2
30.1530	81.9	1.34	82.	24.1	0.04	53.5	65.5
30.1630	81.1	1.36	81.	23.5	0.62	51.5	68.3
30.1730	80.3	1.42	79.	25.5	0.60	53.4	68.8
30.1830	77.4	1.44	76.	25.6	0.51	54.9	74.6
30.1930	75.8	1.42	72.	25.9	0.61	53.1	71.1
30.2030	74.3	1.44	72.	25.5	0.52	50.4	67.7
30.2130	71.5	1.42	71.	25.5	0.16	50.8	68.0
30.2230	58.7	1.64	72.	24.1	0.07	44.2	63.9
30.2330	63.3	1.61	72.	25.8	0.14	44.7	64.0
31.0030	63.6	1.31	71.	19.5	0.20	45.4	57.8
31.0130	68.9	1.26	74.	19.6	1.42	44.4	51.4
31.0230	77.6	1.60	74.	25.5	0.97	50.5	60.5
31.0330	74.6	1.67	76.	24.6	0.70	48.6	64.8
31.0430	74.3	1.56	78.	19.7	0.48	45.8	57.3
31.0530	72.6	1.70	77.	22.9	0.35	58.9	74.7
31.0630	75.1	1.26	76.	22.3	1.38	52.8	58.6
31.0730	80.5	1.26	81.	22.3	1.40	52.1	65.6
31.0830	79.6	1.29	81.	22.7	0.67	54.2	73.5
31.0930	78.9	1.28	81.	22.3	0.78	55.2	72.8

APPENDIX 8. TABLE IV.

RUN 9: DESULPHURISATION PERFORMANCE PAGE 16 OF 16

DAY.HOUR	SULPHUR REMOVAL %	GAS VEL. M/S	D-BED DEPTH CENTIM	AIR/ FUEL % ST.	CAO/S RATIO MOL.	% CAS TO CAO	REGEN. % OUT % OF PRD
31:1030	79.7	1.28	82.	24.4	1.18	51.2	69.7
31:1130	79.8	1.45	88.	26.3	1.08	54.5	77.2
31:1230	74.6	1.40	88.	24.6	0.19	54.7	76.8
31:1330	70.9	1.31	88.	22.6	0.	46.4	63.9
31:1430	68.3	1.29	88.	23.9	0.	-	0.
31:1530	68.4	1.31	87.	22.4	0.11	-	0.
31:1630	66.8	1.79	83.	36.1	5.06	-	0.
31:1730	78.9	1.61	88.	25.8	3.40	42.9	52.7
31:1830	75.1	1.58	81.	22.3	2.45	36.1	47.6
31:1930	81.6	1.66	88.	38.4	3.96	32.7	39.5
STONE CHANGE							
31:2030	84.9	1.60	82.	33.6	4.22	34.5	42.4
31:2130	84.3	1.67	87.	38.0	2.57	41.3	51.2
31:2230	84.2	1.60	86.	28.8	1.40	42.5	53.6
31:2330	84.5	1.53	87.	25.7	1.55	47.6	60.1
32:0030	84.2	1.56	86.	25.4	0.79	52.9	63.3
32:0130	84.6	1.53	83.	26.0	0.41	58.3	64.2
32:0230	82.9	1.49	87.	22.9	0.23	56.9	61.1
32:0330	82.8	1.51	87.	36.7	3.53	48.3	55.7
32:0430	84.7	1.53	88.	23.9	0.48	49.4	60.5
32:0530	84.6	1.51	86.	36.7	1.25	45.3	56.3
32:0630	83.1	1.47	87.	22.3	0.88	54.1	60.7
32:0730	83.6	1.30	86.	36.3	0.86	40.7	45.0
32:0830	83.7	1.30	87.	20.5	0.49	23.5	23.6

APPENDIX C: TABLE 6.

RUN 9: GAS COMPOSITIONS PAGE 1 OF 12

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
1-1930	3.5	13.0	13.2	193.	3.00	1.0	2.4	19.5	19.5	0.	1.13
1-2030	3.7	13.2	13.4	217.	3.50	2.7	3.0	20.0	20.0	0.	0.78
1-2130	0.	14.0	15.0	213.	0.	--	0.	20.0	20.0	0.	0.67
SHUT DOWN AT 1-2130 FOR 4 HOURS											
2-0230	3.5	14.0	13.2	625.	2.00	0.0	1.0	19.9	19.9	0.	0.08
2-0330	3.7	12.7	13.4	595.	1.20	0.0	2.2	19.6	19.6	0.23	0.96
2-0430	4.6	12.2	12.2	534.	1.30	1.3	3.3	18.5	18.5	1.57	1.86
2-0530	3.2	12.2	13.4	383.	0.40	1.0	3.7	19.4	19.4	1.73	1.78
2-0630	3.2	15.4	13.3	353.	0.50	1.9	3.5	18.2	18.2	2.12	1.96
2-0730	2.8	12.2	13.5	373.	0.	2.5	3.1	18.2	18.2	1.96	1.87
2-0830	3.1	12.4	13.4	-	0.	2.0	3.9	18.2	18.2	2.04	1.95
2-0930	1.9	13.2	14.4	-	0.	1.0	7.6	19.0	19.0	0.	1.30
2-1030	2.1	13.2	14.2	527.	0.10	1.7	8.2	19.0	19.0	0.13	1.40
2-1130	1.9	12.7	14.4	535.	2.10	1.0	7.6	19.0	19.0	0.34	1.33
2-1230	2.0	13.0	14.3	545.	0.10	1.3	7.6	19.0	19.0	0.23	0.82
2-1330	1.9	13.0	14.4	575.	0.20	2.2	7.0	20.0	20.0	0.30	0.60
2-1430	1.8	13.0	14.5	615.	0.10	2.7	6.6	21.0	21.0	0.	0.
2-1530	3.5	12.2	13.7	625.	0.	4.6	6.6	21.0	21.0	0.	0.
2-1630	3.5	12.0	13.2	384.	0.	3.0	6.2	21.0	21.0	0.	0.
2-1730	3.5	12.2	13.2	464.	0.	3.2	5.0	21.0	21.0	0.	0.
2-1830	3.0	12.2	13.4	440.	0.	2.5	6.0	21.0	21.0	0.	0.
2-1930	3.2	12.2	13.4	424.	0.	2.0	6.0	21.0	21.0	0.	0.
2-2030	3.3	12.7	13.3	424.	0.	2.7	5.6	21.0	21.0	0.	0.
2-2130	3.1	12.2	13.5	424.	3.	5.0	5.6	21.0	21.0	0.	0.
2-2230	2.9	12.0	13.6	434.	0.	3.0	6.2	21.0	21.0	0.	0.
2-2330	3.0	12.2	13.6	484.	0.	2.5	6.2	21.0	21.0	0.	0.
SHUT DOWN AT 2-2330 FOR 30 HOURS											
4-0530	1.9	13.5	14.3	-	21.00	0.0	0.7	17.3	17.0	1.80	2.80

4-0530	2.0	13.5	14.0	-	0.	1.3	6.0	17.3	17.2	1.88 2.30
4-0630	2.1	13.2	14.1	258.	0.	1.0	6.6	18.0	17.0	1.33 2.17
4-0730	2.9	13.0	13.5	258.	0.	1.3	6.6	18.0	18.0	0.53 1.50
4-0830	2.9	12.7	13.5	283.	0.	1.7	6.6	18.6	18.0	0.44 1.47
4-0930	2.9	12.7	13.5	263.	0.	1.4	6.4	19.2	19.2	0.44 1.24

SHUT DOWN AT 4-0930 FOR 2 HOURS

4-1130	3.4	14.0	13.2	283.	0.	-	0.	19.2	19.2	1.32 3.43
4-1230	6.0	14.0	11.2	302.	0.	-	0.	19.2	19.2	3.10 1.40
4-1330	7.5	14.0	10.0	297.	0.	-	0.	15.9	18.0	3.45 3.12
4-1430	6.5	14.0	10.7	302.	0.	-	0.	15.2	17.0	3.45 3.12
4-1530	4.0	14.0	12.6	323.	0.	0.4	6.4	15.1	17.3	3.36 3.02
4-1630	4.1	14.0	12.5	384.	0.	0.3	6.8	14.5	16.4	3.92 3.02
4-1730	4.1	14.0	12.5	414.	0.	0.3	6.8	14.5	16.5	4.02 3.76
4-1830	4.0	13.0	12.6	404.	0.	0.4	6.2	14.0	17.3	3.18 3.01
4-1930	2.5	12.4	13.7	378.	0.	0.3	6.0	14.6	16.9	3.73 2.74
4-2030	2.8	12.7	13.4	379.	0.	0.3	6.2	14.6	17.3	3.27 2.58
4-2130	2.8	12.4	13.5	354.	0.	0.2	6.8	16.0	17.7	3.01 2.26
4-2230	2.8	12.4	13.5	344.	0.	0.2	6.6	16.2	17.6	2.93 2.22
4-2330	2.8	12.4	13.5	323.	0.	0.2	6.6	16.4	17.6	2.84 2.22
5-0030	2.8	12.4	13.5	338.	0.	0.2	6.8	16.6	18.1	2.76 1.98
5-0130	2.8	12.4	13.5	364.	0.	0.2	7.0	16.7	18.1	2.60 1.98
5-0230	2.8	12.7	13.5	389.	0.	0.1	7.2	16.8	18.1	2.52 2.02
5-0330	2.8	12.7	13.5	364.	0.	0.1	6.8	16.9	18.3	2.52 1.87
5-0430	2.8	12.7	13.5	293.	0.	0.4	6.9	17.0	18.3	2.44 1.87
5-0530	2.7	12.7	13.6	273.	0.	0.4	6.7	17.0	18.3	2.44 1.87
5-0630	2.4	13.2	13.0	333.	0.	0.6	5.8	17.9	18.4	2.44 1.82
5-0730	2.4	13.0	13.0	293.	0.	0.6	6.0	17.3	18.4	2.36 1.82

APPENDIX C TABLE 6.

RUN 9: GAS COMPOSITIONS PAGE 2 OF 11

DAY-HOUR	FLUE GAS O_2 %	FLUE GAS CO_2 VOL % ANAL	FLUE GAS CO_2 VOL % CALC	FLUE GAS SO_2 PPM	REGENERATOR GAS O_2 %	REGENERATOR GAS CO_2 %	REGENERATOR GAS SO_2 %	GASIFIER INLET GAS O_2 VOL % ANAL	GASIFIER INLET GAS O_2 VOL % CALC	GASIFIER INLET GAS CO_2 VOL % ANAL	GASIFIER INLET GAS CO_2 VOL % CALC
5-0830	3.2	12.4	13.2	273.	0.	0.6	6.0	17.3	18.5	2.20	1.75
5-0930	3.0	12.4	13.4	260.	0.	0.8	6.2	17.3	18.5	2.20	1.71
5-1030	3.0	12.4	13.4	253.	0.	0.7	6.0	16.7	18.0	2.84	2.00
5-1130	3.2	12.4	13.2	246.	0.	0.5	5.8	16.6	18.1	2.76	2.05
5-1230	3.4	12.4	13.0	243.	0.	0.4	6.2	16.9	18.1	2.84	2.05
5-1330	3.2	12.4	13.2	253.	0.	0.4	6.2	16.9	18.2	2.67	1.98
5-1430	5.0	14.0	11.8	270.	0.	0.3	6.0	16.9	17.8	3.10	2.81
5-1530	5.0	14.0	11.8	258.	0.	0.1	6.0	16.9	17.6	3.10	2.99
5-1630	5.0	14.0	11.6	242.	0.	0.2	6.0	16.7	17.6	3.10	2.99
5-1730	5.0	14.0	11.8	232.	0.	0.4	6.0	16.6	17.5	3.01	3.04
5-1830	4.8	14.0	12.0	303.	0.	0.4	6.0	16.6	17.5	3.01	3.04
5-1930	4.8	14.0	12.0	319.	0.	0.4	6.0	16.6	17.5	3.10	2.99
5-2030	4.6	14.0	12.1	298.	0.	0.5	5.6	16.7	17.5	3.10	2.99
5-2130	4.3	14.0	12.3	253.	0.	0.4	6.2	16.9	17.8	2.84	2.64
5-2230	4.7	14.0	12.0	260.	0.	0.3	6.2	16.9	18.0	2.84	2.59
5-2330	5.0	14.0	11.3	232.	0.	0.2	6.2	16.9	18.2	2.84	2.59
6-0030	5.3	14.0	11.4	207.	0.	0.2	5.6	17.0	18.1	2.84	2.60
6-0130	6.0	14.0	11.1	212.	0.	0.2	5.6	17.0	18.3	2.84	2.56
6-0230	5.4	14.0	11.2	212.	0.	0.2	5.6	17.1	18.2	2.76	2.56
6-0330	5.1	14.0	11.7	229.	0.	0.3	5.2	17.0	18.1	2.74	2.57
6-0430	5.0	14.0	11.8	222.	0.	0.4	5.0	16.9	18.2	2.93	2.42
6-0530	5.0	14.0	11.8	207.	0.	0.4	5.0	17.0	18.3	2.93	2.38
6-0630	5.0	14.0	11.8	197.	0.	0.4	5.0	17.0	18.3	2.93	2.38
6-0730	5.0	14.0	11.8	167.	0.	0.2	5.2	17.0	18.2	2.76	2.42
6-0830	5.0	14.0	11.8	177.	0.	0.4	5.0	17.0	18.2	2.76	2.47
6-0930	4.2	14.0	12.4	167.	0.	0.2	6.2	17.3	18.0	2.76	2.34
6-1030	4.0	14.0	12.5	-	0.	0.2	5.4	17.3	18.2	2.76	2.34
6-1130	4.7	14.0	12.6	276.	0.	0.2	4.6	17.4	18.1	2.93	2.42

6-1230	4.0	14.0	12.5	242.	0.	9.2	4.6	17.4	18.1	2.76	2.40
6-1330	4.2	14.0	12.4	211.	0.	8.2	5.2	17.5	18.1	2.76	2.42
6-1430	4.2	14.0	12.4	214.	0.	8.2	5.0	17.5	18.2	2.76	2.34
6-1530	4.0	14.0	12.6	202.	0.	9.7	4.2	16.4	17.4	3.45	2.98
6-1630	4.0	14.0	12.6	198.	0.	3.0	5.0	16.9	17.6	3.17	2.70
6-1730	3.9	14.0	12.7	210.	0.	-	0.	17.5	17.6	2.65	2.80
6-1830	3.9	14.0	12.7	216.	0.	-	0.	17.5	17.6	2.69	2.80
6-1930	3.8	14.0	12.9	265.	0.	-	0.	19.1	18.1	2.94	2.33
6-2030	3.8	14.0	12.8	293.	0.	-	0.	17.5	17.1	2.60	3.10

SHUT DOWN AT 6-2030 FOR 4 HOURS

7-0130	2.6	14.2	13.0	-	0.	5.4	6.4	21.0	21.0	0.	0.
7-0230	3.0	14.0	13.5	303.	0.	1.9	7.0	21.0	21.0	0.	0.
7-0330	2.9	14.0	13.6	283.	0.10	0.9	6.0	21.0	21.0	0.	0.
7-0430	3.1	14.0	13.4	340.	0.	0.7	7.0	21.0	21.0	0.	0.
7-0530	3.1	12.2	13.4	343.	0.	1.1	6.6	21.0	21.0	0.	0.
7-0630	3.0	12.4	13.5	295.	0.	1.8	6.6	21.0	21.0	0.	0.
7-0730	2.9	12.4	13.6	298.	0.	2.2	6.2	21.0	21.0	0.	0.
7-0830	2.9	12.4	13.6	300.	0.	2.5	6.2	21.0	21.0	0.	0.
7-0930	2.9	12.4	13.6	298.	0.	3.2	6.6	21.0	21.0	0.	0.
7-1030	3.5	14.0	13.2	313.	0.	3.5	6.4	21.0	21.0	0.	0.
7-1130	3.2	14.0	13.3	303.	0.	4.1	6.2	21.0	21.0	0.	0.
7-1230	4.2	14.0	12.6	305.	0.	3.7	6.8	21.0	21.0	0.	0.
7-1330	4.2	14.0	12.6	318.	0.	3.6	6.8	21.0	21.0	0.	0.
7-1430	4.2	14.0	12.6	303.	0.	4.5	5.8	21.0	21.0	0.	0.
7-1530	4.2	12.2	12.5	314.	0.	6.8	4.2	21.0	21.0	0.	0.
7-1630	4.9	14.0	12.0	282.	0.	4.1	6.2	21.0	21.0	0.	0.
7-1730	5.5	14.0	11.6	182.	0.	3.5	6.6	21.0	21.0	0.	0.
7-1830	5.7	14.0	11.4	171.	0.	3.4	6.8	21.0	21.0	0.	0.
7-1930	5.5	14.0	11.6	161.	0.	2.6	8.2	21.0	21.0	0.	0.
7-2030	4.2	14.0	12.5	-	0.	1.9	6.2	21.0	21.0	0.	0.
7-2130	4.5	14.0	12.3	-	0.	1.3	6.8	21.0	21.0	0.	0.
7-2230	4.1	14.0	12.6	191.	0.56	1.1	6.8	21.0	21.0	0.	0.
7-2330	4.0	14.0	12.7	157.	0.50	1.0	6.6	21.0	21.0	0.	0.

APPENDIX C TABLE V-

RUN 9: GAS COMPOSITIONS PAGE 3 OF 11

	FLUE GAS				REGENERATOR GAS			GASIFIER INLET GAS			
DAY-HOUR	O2 %	CO2 VOL % ANAL	CO2 VOL % CALC	SO2 PPM	O2 %	CO2 %	SO2 %	O2 VOL % ANAL	O2 VOL % CALC	CO2 VOL % ANAL	CO2 VOL % CALC
8-0030	4.0	14.0	12.7	157.	0.50	0.9	6.6	21.0	21.0	0.	0.
8-0130	3.9	14.0	12.8	150.	0.50	1.1	6.6	21.0	21.0	0.	0.
8-0230	3.3	14.0	13.2	157.	0.50	1.2	6.6	21.0	21.0	0.	0.
8-0330	3.1	14.0	13.4	167.	0.50	1.4	6.6	21.0	21.0	0.	0.
8-0430	3.1	14.0	13.4	162.	0.50	1.6	6.6	21.0	21.0	0.	0.
8-0530	3.1	12.2	13.4	167.	0.50	1.6	6.6	21.0	21.0	0.	0.
8-0630	3.6	12.2	13.5	167.	0.50	1.6	6.6	21.0	21.0	0.	0.
8-0730	3.0	12.2	13.5	177.	0.50	1.4	6.4	21.0	21.0	0.	0.
8-0830	3.6	12.2	13.5	192.	0.50	1.6	6.0	21.0	21.0	0.	0.
8-0930	3.1	12.1	13.4	182.	0.50	1.7	6.1	21.0	21.0	0.	0.
8-1030	3.1	14.0	13.4	182.	0.	1.7	6.2	21.0	21.0	0.	0.
8-1130	3.0	14.0	13.4	172.	0.	2.0	6.2	21.0	21.0	0.	0.
8-1230	3.1	12.2	13.4	-	0.	1.7	6.2	21.0	21.0	0.	0.
8-1330	3.1	12.2	13.4	172.	0.	1.8	6.0	21.6	21.0	0.	0.
8-1430	3.0	12.2	13.5	157.	0.	2.0	6.2	21.2	21.0	0.	0.
8-1530	2.9	12.2	13.5	162.	0.	3.0	6.2	21.0	21.0	0.	0.
8-1630	3.0	12.2	13.4	202.	0.	7.5	3.1	21.0	21.0	0.	0.
8-1730	2.8	12.4	13.6	187.	0.	4.2	6.1	21.0	21.0	0.	0.
8-1830	3.0	12.2	13.4	172.	0.	6.3	4.6	21.0	21.0	0.	0.
8-1930	2.9	12.2	13.5	172.	0.	4.3	5.8	21.0	21.0	0.	0.
8-2030	3.0	12.2	13.5	125.	0.	4.0	5.8	21.0	21.0	0.	0.
8-2130	3.0	12.2	13.5	106.	0.	3.6	5.8	21.0	21.0	0.	0.
SHUT DOWN AT 8-2130 FOR 9 HOURS											
9-0630	2.2	13.0	14.1	263.	0.50	1.6	5.6	21.0	21.0	0.	0.
9-0730	2.1	15.7	14.2	252.	0.60	1.4	5.8	21.0	21.0	0.	0.
9-0830	2.9	13.0	14.3	257.	1.00	2.3	6.6	21.0	21.0	0.	0.
9-0930	2.0	13.0	14.2	239.	2.20	1.7	6.6	21.0	21.0	0.	0.
9-1030	2.0	13.0	14.2	212.	0.40	1.5	6.6	21.0	21.0	0.	0.

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9-1130      2.3  13.0 14.0  212.  0.50  2.0  6.6   21.0 21.0  0.   0.
9-1230      2.3  12.7 14.0   -    0.    2.1  6.6   21.0 21.0  0.   0.
9-1330      2.7  12.7 13.7  207.  0.    2.0  6.6   21.0 21.0  0.   0.
9-1430      2.7  12.7 13.7  205.  0.    1.6  6.8   21.0 21.0  0.   0.
9-1530      2.7  12.7 13.7  202.  0.    1.9  6.6   21.0 21.0  0.   0.
9-1630      2.7  12.7 13.7  215.  0.    1.4  6.6   21.0 21.0  0.   0.
9-1730      2.8  12.7 13.6  197.  0.    1.6  6.6   21.0 21.0  0.   0.
9-1830      2.9  12.7 13.6  185.  0.    1.4  6.4   21.0 21.0  0.   0.
9-1930      2.9  12.4 13.5  182.  0.    1.7  6.6   21.0 21.0  0.   0.
9-2030      3.0  12.4 13.5  180.  0.    2.1  6.2   21.0 21.0  0.   0.

        SHUT DOWN AT  9-2030 FOR   5 HOURS

10-0230     3.5  14.0 12.9   -    0.     -   0.    21.0 21.0  0.   0.
10-0330     2.6  12.4 13.9  202.  0.40  3.5  5.6   21.0 21.0  0.   0.
10-0430     3.2  12.4 13.3  252.  0.40  5.7  5.4   21.0 21.0  0.   0.
10-0530     3.2  12.4 13.3  222.  0.40  3.6  5.8   21.0 21.0  0.   0.
10-0630     3.2  12.2 13.3  192.  0.50  1.9  6.4   21.0 21.0  0.   0.
10-0730     3.0  12.2 13.5  187.  0.40  2.2  6.2   21.0 21.0  0.   0.
10-0830     3.2  12.4 13.3  182.  0.40  1.5  6.2   21.0 21.0  0.   0.
10-0930     3.5  12.2 12.9  172.  0.    1.4  5.2   21.0 21.0  0.   0.
10-1030     3.9  12.2 12.8  167.  0.    1.8  5.8   21.0 21.0  0.   0.
10-1130     3.8  14.0 12.9  162.  0.    1.5  6.0   21.0 21.0  0.   0.
10-1230     3.6  12.2 13.1  192.  0.    1.6  6.2   21.0 21.0  0.   0.
10-1330     3.4  12.2 13.2  192.  0.40  1.7  6.2   21.0 21.0  0.   0.
10-1430     3.4  12.2 13.2  192.  0.40  1.9  6.2   21.0 21.0  0.   0.
10-1530     3.3  12.4 13.3  197.  0.30  2.3  6.0   21.0 21.0  0.   0.
10-1630     3.1  12.4 13.4  197.  0.    2.6  5.8   21.0 21.0  0.   0.
10-1730     2.9  12.7 13.6  202.  0.    3.0  5.8   21.0 21.0  0.   0.
10-1830     2.9  12.7 13.6  202.  0.    3.4  5.8   21.0 21.0  0.   0.
10-1930     2.9  12.2 13.6  202.  0.    3.9  5.8   21.0 21.0  0.   0.
10-2030     3.1  12.7 13.4  207.  0.    3.9  5.8   21.0 21.0  0.   0.
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APPENDIX D: TABLE 9.

RUN 9: GAS COMPOSITIONS PAGE 4 OF 11

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
10-2130	3.0	12.7	13.5	287.	0.	3.9	5.6	21.0	21.0	0.	0.
10-2230	3.1	12.4	13.4	282.	0.20	3.7	5.5	21.0	21.0	0.	0.
10-2330	3.0	12.4	13.5	212.	0.50	3.9	5.4	21.0	21.0	0.	0.
11-0030	3.0	12.4	13.5	287.	1.20	2.9	5.2	21.0	21.0	0.	0.
11-0130	3.0	12.4	13.5	2?2.	1.00	3.0	5.4	21.0	21.0	0.	0.
11-0230	3.0	12.4	13.5	287.	0.50	2.9	6.6	21.0	21.0	0.	0.
11-0330	3.0	12.4	13.5	-	1.50	2.7	6.2	21.0	21.0	0.	0.
11-0430	2.8	12.4	13.6	227.	1.50	2.5	6.6	21.0	21.0	0.	0.
11-0530	3.0	12.4	13.5	247.	3.10	4.1	6.0	21.0	21.0	0.	0.
11-0630	3.0	12.7	13.5	273.	0.60	5.4	2.7	21.0	21.0	0.	0.
11-0730	2.8	12.4	13.6	288.	0.	6.7	3.9	21.0	21.0	0.	0.
11-0830	2.6	12.4	13.8	258.	0.20	6.8	3.1	21.0	21.0	0.	0.
11-0930	2.7	12.7	13.7	227.	0.20	5.7	4.6	21.0	21.0	0.	0.
11-1030	2.3	13.0	14.0	222.	0.30	4.1	6.2	21.0	21.0	0.	0.
11-1130	2.6	12.7	13.8	282.	0.70	3.1	7.2	21.0	21.0	0.	0.
11-1230	2.7	12.7	13.7	292.	0.30	2.8	7.2	21.0	21.0	0.	0.
11-1330	2.7	12.7	13.7	282.	0.30	2.1	7.4	21.0	21.0	0.	0.
11-1430	2.8	12.7	13.6	288.	0.30	2.2	7.2	21.0	21.0	0.	0.
11-1530	2.5	12.7	13.9	282.	0.10	2.6	6.6	21.0	21.0	0.	0.
11-1630	2.8	12.4	13.6	222.	0.	3.6	6.6	21.0	21.0	0.	0.
11-1730	2.5	12.7	13.9	237.	0.	3.9	6.2	21.0	21.0	0.	0.
11-1830	2.8	12.7	13.6	237.	0.	3.4	5.8	21.0	21.0	0.	0.
11-1930	3.0	12.7	13.5	222.	0.	2.8	6.0	21.0	21.0	0.	0.
11-2030	3.1	12.7	13.4	282.	0.10	1.8	6.[illegible]	21.0	21.0	0.	0.
11-2130	3.2	12.4	13.3	282.	0.30	1.5	6.2	21.0	21.0	0.	0.
11-2230	3.2	12.4	13.4	287.	0.40	1.4	6.4	21.0	21.0	0.	0.
11-2330	3.2	12.4	13.4	287.	0.50	1.7	6.6	21.0	21.0	0.	0.
12-0030	3.2	12.4	13.3	287.	0.50	1.4	6.4	21.0	21.0	0.	0.

12-0130	3-0	12-4	13-4	282-	0-40	2-0	6-8	21-0	21-0	0-	0-
12-0230	3-0	12-4	13-4	287-	0-40	2-3	6-6	21-0	21-0	0-	0-
12-0330	3-2	12-4	13-3	217-	0-50	3-0	6-6	21-0	21-0	0-	0-
12-0430	2-6	12-4	13-7	243-	0-	6-8	3-3	21-0	21-0	0-	0-
12-0530	2-2	12-7	14-0	263-	0-	6-0	3-5	21-0	21-0	0-	0-
12-0630	2-2	12-7	14-0	212-	2-40	5-2	5-2	21-0	21-0	0-	0-
12-0730	2-2	12-7	14-1	182-	0-20	3-0	7-2	21-0	21-0	0-	0-
12-0830	2-2	12-7	14-1	-	0-40	1-8	7-4	21-0	21-0	0-	0-
12-0930	2-5	12-7	13-6	-	0-30	1-8	7-2	21-0	21-0	0-	0-
12-1030	2-4	12-7	13-9	212-	0-30	1-5	7-2	21-0	21-0	0-	0-
12-1130	2-3	12-7	14-0	287-	1-10	1-4	7-7	21-0	21-0	0-	0-
12-1230	2-1	12-7	14-2	217-	0-40	1-7	7-4	21-0	21-0	0-	0-
12-1330	2-5	12-7	13-6	222-	0-40	1-8	6-6	21-0	21-0	0-	0-
12-1430	2-3	12-7	14-0	227-	0-40	2-2	6-4	21-0	21-0	0-	0-
12-1530	2-2	12-7	14-1	238-	0-30	2-6	6-4	21-0	21-0	0-	0-
12-1630	2-1	12-7	14-1	238-	0-30	2-7	6-6	21-0	21-0	0-	0-
12-1730	1-8	13-0	14-4	243-	0-20	2-9	5-6	21-0	21-0	0-	0-
12-1830	1-8	13-0	14-4	246-	0-20	2-5	6-6	21-0	21-0	0-	0-
12-1930	2-2	12-7	14-1	248-	0-20	2-7	6-6	21-0	21-0	0-	0-
12-2030	1-2	12-7	14-6	253-	0-20	5-8	6-6	21-0	21-0	0-	0-
12-2130	2-2	12-7	14-1	263-	0-	2-3	7-8	21-0	21-0	0-	0-
12-2230	2-2	12-7	14-1	288-	0-	2-5	6-6	21-0	21-0	0-	0-
12-2330	2-3	12-4	14-0	293-	0-	3-0	6-4	21-0	21-0	0-	0-
13-0030	2-5	12-4	13-6	295-	0-	3-2	6-2	21-0	21-0	0-	0-
13-0130	2-5	12-4	13-6	253-	0-	4-5	5-8	21-0	21-0	0-	0-
13-0230	2-2	12-7	14-0	293-	0-	5-4	5-6	21-0	21-0	0-	0-
13-0330	2-3	12-4	14-0	303-	0-	5-4	5-6	21-0	21-0	0-	0-
13-0430	2-2	12-7	14-0	313-	0-	6-0	3-1	21-0	21-0	0-	0-
13-0530	2-2	12-7	14-0	323-	0-	7-8	2-7	21-0	21-0	0-	0-
13-0630	2-9	14-2	13-5	348-	0-	5-2	3-1	21-0	21-0	0-	0-
13-0730	2-6	12-2	13-6	353-	0-	3-0	6-2	21-0	21-0	0-	0-
13-0830	3-2	14-0	13-3	318-	0-	3-7	4-2	21-0	21-0	0-	0-
13-0930	3-2	12-2	13-3	323-	0-40	7-4	2-7	21-0	21-0	0-	0-

APPENDIX D: TABLE 6-

RUN 9: GAS COMPOSITIONS PAGE 5 OF 11

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
SHUT DOWN AT 13-1130 FOR 13 HOURS											
14-0130	2.8	12.7	13.6	404.	0.	1.9	6.8	21.0	21.0	0.	0.
14-0230	2.8	12.7	13.6	353.	0.	3.1	6.6	21.0	21.0	0.	0.
14-0330	2.5	13.0	13.8	308.	0.	3.6	6.6	21.0	21.0	0.	0.
14-0430	2.5	13.0	13.8	323.	0.	3.7	7.0	21.0	21.0	0.	0.
14-0530	2.2	13.0	14.1	333.	0.	6.0	5.0	21.0	21.0	0.	0.
14-0630	2.2	13.0	14.0	303.	0.	6.3	5.0	21.0	21.0	0.	0.
14-0730	2.2	12.7	14.0	323.	0.	6.9	3.7	21.0	21.0	0.	0.
14-0830	2.2	14.0	14.0	348.	0.	5.2	5.4	21.0	21.0	0.	0.
14-0930	2.5	12.4	13.8	323.	0.	7.2	3.1	21.0	21.0	0.	0.
14-1030	2.5	12.4	13.8	313.	0.10	6.9	0.3	21.0	21.0	0.	0.
14-1130	2.6	12.4	13.8	288.	0.	0.3	1.0	21.0	21.0	0.	0.
14-1230	2.6	12.7	13.7	273.	0.	7.4	2.7	21.0	21.0	0.	0.
14-1330	1.8	13.2	14.3	293.	0.40	2.8	8.2	21.0	21.0	0.	0.
14-1430	2.5	12.7	13.8	313.	0.40	1.8	7.0	21.0	21.0	0.	0.
14-1530	2.4	12.7	13.9	318.	0.88	1.7	6.8	21.2	21.0	0.	0.
14-1630	2.1	12.7	14.1	328.	2.50	1.2	7.2	21.0	21.0	0.	0.
14-1730	2.1	13.0	14.1	328.	0.10	2.2	7.4	21.0	21.0	0.	0.
14-1830	3.6	12.4	13.0	313.	0.10	1.9	6.0	21.0	21.0	0.	0.
14-1930	2.5	12.7	13.7	303.	3.10	2.0	7.0	18.0	17.3	2.52	2.56
14-2030	2.1	12.7	14.1	293.	0.	2.2	7.2	18.3	18.3	2.44	1.81
14-2130	2.1	12.7	14.1	293.	0.	2.6	6.8	18.3	18.3	2.52	1.81
14-2230	2.0	13.0	14.1	-	0.	2.7	6.8	18.3	18.3	2.44	1.84
14-2330	1.8	13.0	14.2	313.	0.	2.9	6.5	18.3	18.3	2.36	1.83
15-0030	2.1	13.2	14.0	328.	0.	3.3	6.6	18.3	18.3	2.36	1.80
15-0130	2.0	13.0	14.1	323.	0.	3.5	6.6	17.8	18.5	2.76	1.60
15-0230	1.9	13.0	14.2	328.	0.	3.7	6.6	17.6	18.0	2.93	1.40
15-0330	2.0	13.0	14.1	324.	0.	2.4	6.6	18.3	18.3	2.52	1.84

15-0430	1.9	13.1	14.2	313.	0.	2.3	6.6	18.2	18.2	2.50	1.92
15-0530	1.9	13.1	14.2	313.	0.	2.9	7.0	18.2	18.2	2.40	1.92
15-0630	2.0	12.4	14.1	303.	0.	2.3	6.0	18.1	18.1	2.44	1.98
15-0730	2.5	12.2	13.8	305.	0.	2.3	6.8	20.4	20.4	0.63	0.40
15-0830	2.2	15.7	13.9	298.	0.	3.1	6.2	17.6	17.4	1.96	2.44
15-0930	2.4	12.4	13.6	303.	0.	2.0	6.0	18.4	18.4	2.12	1.74
15-1030	2.2	12.7	14.0	295.	2.20	1.7	6.2	18.4	18.4	2.12	1.76
15-1130	3.2	14.0	13.2	293.	0.	1.6	6.6	18.8	15.8	1.96	1.73
15-1230	3.0	12.2	13.4	293.	5.	1.9	6.2	18.6	18.6	2.04	1.62
15-1330	3.2	12.2	13.3	303.	0.	1.6	6.6	21.0	21.0	0.	0.
15-1430	4.2	14.8	12.6	303.	0.	1.6	6.4	21.0	21.0	0.	0.
15-1530	4.5	14.0	12.4	277.	0.	1.9	6.8	21.0	21.0	0.	0.
15-1630	4.5	14.0	12.3	287.	0.60	2.5	5.6	21.0	21.0	0.	0.

SHUT DOWN AT 15-1630 FOR 14 HOURS

16-0730	4.1	14.0	12.6	305.	0.	2.5	7.0	19.3	19.3	1.33	1.41
16-0830	4.1	14.0	12.6	305.	0.	2.1	7.0	19.1	19.6	1.33	1.16
16-0930	4.1	14.0	12.6	295.	0.	1.1	5.0	19.6	19.6	1.33	1.16
16-1030	4.0	12.2	12.6	268.	0.	2.5	7.4	18.8	18.8	2.60	1.58
16-1130	3.2	12.2	13.2	273.	0.	1.8	6.8	17.6	17.0	3.45	2.76
16-1230	2.0	12.7	14.1	-	0.	1.5	6.6	17.4	16.7	3.63	2.80
16-1330	2.0	12.7	14.1	364.	0.	1.4	6.4	17.2	16.7	3.63	2.80
16-1430	2.2	12.7	13.9	374.	0.	1.3	6.2	17.2	16.7	3.54	2.80
16-1530	2.5	12.7	13.7	374.	0.	1.3	6.0	17.2	16.8	3.45	2.80

SHUT DOWN AT 16-1530 FOR 2 HOURS

16-1730	4.0	14.0	12.7	403.	0.	0.2	0.7	20.4	20.4	3.54	0.40
16-1830	3.0	12.4	13.4	363.	0.50	1.1	5.4	20.6	20.6	3.73	0.28
16-1930	2.0	13.0	14.2	354.	7.50	1.2	5.6	20.6	20.6	3.45	0.27

APPENDIX G: TABLE 9.

RUN 9: GAS COMPOSITIONS PAGE 6 OF 11

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
16-2030	1.0	13.2	14.1	395.	0.50	1.0	5.4	17.6	15.3	4.42	3.90
16-2130	2.0	13.0	14.0	405.	0.70	1.1	5.0	16.0	15.3	4.21	3.87
16-2230	2.0	13.0	14.0	405.	0.80	1.2	4.8	15.7	15.4	4.32	3.84
16-2330	2.0	13.0	14.0	385.	0.80	1.3	5.0	15.7	15.4	4.21	3.84
SHUT DOWN AT 16-2330 FOR 3 HOURS											
17-0330	3.4	12.2	13.0	444.	0.20	2.0	5.6	17.2	17.4	3.10	2.52
17-0430	3.1	12.7	13.4	505.	0.10	1.7	5.4	17.2	17.3	3.10	2.64
17-0530	2.9	12.7	13.5	505.	0.10	1.9	5.4	17.2	17.2	3.10	2.64
17-0630	2.8	12.7	13.6	455.	0.10	2.6	5.4	17.2	17.3	3.10	2.59
17-0730	2.8	12.7	13.6	444.	0.10	2.8	5.0	17.3	17.3	3.10	2.61
17-0830	2.7	12.7	13.6	478.	0.10	2.5	5.4	17.2	17.5	3.01	2.46
17-0930	2.6	12.7	13.7	480.	0.10	3.0	5.4	17.2	17.5	3.10	2.38
17-1030	2.5	12.7	13.8	478.	0.50	2.8	5.0	17.2	17.8	2.84	2.23
17-1130	2.4	12.7	13.8	440.	0.60	2.6	5.0	17.2	17.5	2.84	2.38
17-1230	2.6	12.7	13.7	465.	0.50	2.3	4.6	17.4	17.5	2.84	2.38
17-1330	3.2	12.2	13.3	424.	0.56	2.5	5.4	17.4	17.4	2.84	2.43
17-1430	3.0	12.2	13.4	404.	0.60	3.1	5.2	17.2	17.0	2.84	2.12
17-1530	2.2	12.7	14.0	445.	0.50	2.7	5.4	17.4	17.7	2.76	2.25
17-1630	2.0	12.7	14.2	505.	0.60	2.1	5.0	17.4	17.5	2.93	2.33
17-1730	3.0	12.4	13.4	454.	0.50	2.2	4.6	18.4	18.4	2.12	1.80
17-1830	2.5	12.7	13.9	343.	0.20	3.0	5.6	19.1	19.1	1.61	1.30
17-1930	3.0	12.4	13.5	374.	0.40	4.4	5.6	19.2	19.2	1.65	1.24
17-2035	3.0	12.4	13.5	374.	0.20	3.7	6.2	19.1	19.1	1.81	1.33
17-2130	3.2	12.2	13.4	424.	0.30	1.7	6.6	21.0	21.0	0.	0.
17-2230	3.1	12.4	13.5	429.	0.	1.5	7.4	21.0	21.0	0.	0.
17-2330	3.0	12.2	13.5	405.	0.	2.5	7.4	21.0	21.0	0.	0.
18-0030	3.1	12.4	13.5	404.	0.	2.6	7.4	21.0	21.0	0.	0.
18-0130	2.3	12.4	13.6	419.	0.	2.2	7.4	21.0	21.6	0.	0.

18.0230	2.9	12.4	13.6	419.	0.	3.1	7.6	21.0	21.0	0.	0.
18.0330	2.9	12.4	13.6	409.	0.	3.1	7.4	21.0	21.0	0.	0.
18.0430	3.0	12.2	13.5	-	0.	3.0	7.4	21.0	21.0	0.	0.
18.0530	3.0	12.2	13.5	424.	0.	3.5	7.4	21.0	21.0	0.	0.
18.0630	3.1	14.0	13.5	414.	0.	6.2	4.6	21.0	21.0	0.	0.
18.0736	3.5	14.0	13.2	403.	0.	7.5	2.9	21.0	21.0	0.	0.
18.0830	4.1	14.0	12.7	383.	0.	6.4	3.0	21.0	21.0	0.	0.
18.0935	4.3	14.0	12.6	353.	0.	6.7	3.9	21.0	21.0	2.	0.
18.1030	4.9	14.0	12.1	-	0.	6.9	3.5	21.0	21.0	0.	0.
18.1130	3.2	12.2	13.4	383.	0.	5.1	5.6	21.0	21.0	0.	0.
18.1230	3.2	12.1	13.4	404.	0.	5.4	4.2	21.0	21.0	0.	0.
18.1330	3.2	14.2	13.3	434.	0.	8.6	1.0	18.0	18.5	2.60	1.73
18.1430	5.0	14.0	12.0	393.	0.	5.8	4.8	21.0	21.0	0.	0.
18.1530	3.5	14.0	13.1	419.	0.	7.4	2.9	21.0	21.0	0.	0.
18.1630	3.5	14.0	13.1	419.	0.	7.7	2.7	21.0	21.0	0.	0.
18.1730	3.5	14.0	13.1	414.	0.	7.7	2.4	21.0	21.0	0.	0.
18.1830	3.8	14.0	12.8	424.	0.	7.1	3.5	0.	17.7	2.60	2.60
18.1930	4.1	14.9	12.6	383.	0.	5.4	5.0	0.	18.4	2.12	2.12
18.2030	4.5	14.0	12.3	343.	0.	3.9	6.6	0.	19.1	1.65	1.65
18.2130	4.1	14.0	12.6	323.	0.	2.5	6.6	0.	19.0	1.65	1.65
18.2230	3.9	14.0	12.8	318.	0.	3.7	7.0	0.	19.1	1.57	1.57
18.2330	3.2	12.2	13.3	384.	0.	3.2	6.8	0.	18.7	1.57	1.57
19.0030	3.1	12.4	13.3	404.	0.	2.7	7.0	0.	18.7	1.57	1.57
19.0130	3.2	14.0	13.3	394.	0.	0.1	2.7	0.	20.3	0.53	0.53
19.0230	3.2	12.2	13.3	404.	0.	1.9	7.2	0.	19.6	0.99	0.99
19.0330	3.2	12.4	13.3	424.	2.	1.9	6.6	0.	18.1	2.04	2.04
19.0430	3.2	12.4	13.2	439.	0.	2.1	6.6	2.	17.9	2.20	2.20
19.0530	3.1	12.4	13.3	449.	0.	2.1	6.8	0.	17.9	2.12	2.12
19.0630	3.1	12.4	13.3	499.	0.	1.5	6.8	0.	18.1	2.04	2.04
19.0730	3.1	12.2	13.3	504.	0.	1.4	6.4	0.	17.9	2.12	2.12
19.0830	3.1	12.4	13.3	505.	0.	1.8	6.4	0.	19.1	2.04	2.04
19.0930	3.8	14.0	12.8	474.	0.	2.2	5.8	0.	18.5	2.04	2.04
19.1030	3.2	12.4	13.3	-	0.	2.2	6.4	0.	20.4	0.44	0.44

APPENDIX E: TABLE 6.

RUN 9: GAS COMPOSITIONS PAGE 7 OF 11

DAY-HOUR	FLUE GAS O2 %	CO2 VOL % ANAL	 CALC	SO2 PPM	REGENERATOR GAS O2 %	CO2 %	SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	 CALC	CO2 VOL % ANAL	 CALC
19-1130	2.8	12.2	13.6	283.	0.	2.3	6.0	0.	20.3	0.00	0.00
19-1230	3.0	14.0	13.4	293.	0.	2.5	5.8	21.0	21.0	0.	0.
19-1330	3.0	14.0	13.3	273.	0.	2.6	6.0	21.0	21.0	0.	0.
SHUT DOWN AT 19-1330 FOR 2 HOURS											
19-1530	3.2	14.0	13.3	243.	0.	5.1	4.8	21.0	21.0	0.	0.
19-1630	3.5	14.0	13.1	232.	0.	4.3	4.6	21.0	21.0	0.	0.
19-1730	3.5	12.2	13.1	212.	0.	3.3	4.6	21.0	21.0	0.	0.
19-1830	3.6	14.0	13.0	212.	0.	2.5	4.6	21.0	21.0	0.	0.
19-1930	3.8	14.0	12.9	212.	0.	3.0	4.6	21.0	21.0	0.	0.
19-2030	3.9	14.0	12.8	197.	0.	2.7	4.6	21.0	21.0	0.	0.
19-2130	4.0	14.0	12.7	192.	0.	2.4	5.2	21.0	21.0	0.	0.
19-2230	4.0	14.0	12.7	202.	0.	2.3	5.6	21.0	21.0	0.	0.
STONE CHANGE											
19-2330	4.0	14.0	12.7	232.	0.	1.9	5.6	21.0	21.0	0.	0.
20-0030	4.0	14.0	12.7	157.	0.10	1.8	5.4	21.0	21.0	0.	0.
20-0130	3.6	12.2	13.0	152.	0.10	1.8	5.4	21.0	21.0	0.	0.
20-0230	3.5	14.0	13.1	147.	0.	2.0	5.4	21.0	21.0	0.	0.
20-0330	3.5	14.0	13.1	162.	0.	2.6	5.4	21.0	21.0	0.	0.
20-0430	3.5	14.0	13.1	162.	0.	3.5	5.4	21.0	21.0	0.	0.
20-0530	3.0	12.4	13.5	172.	0.	3.7	5.2	21.0	21.0	0.	0.
20-0630	2.9	12.4	13.5	177.	0.	4.2	5.4	21.0	21.0	0.	0.
20-0730	2.9	12.4	13.5	189.	0.	4.2	4.8	21.0	21.0	0.	0.
20-0830	3.2	14.0	13.3	182.	0.50	3.4	5.2	21.0	21.0	0.	0.
STONE CHANGE											
20-0930	3.2	14.0	13.3	187.	0.	3.8	5.0	21.0	21.0	0.	0.
20-1030	3.3	14.0	13.2	192.	0.40	4.2	4.6	21.0	21.0	0.	0.
20-1130	3.3	12.2	13.2	212.	1.00	2.8	5.0	21.0	21.0	0.	0.
20-1230	3.4	14.0	13.2	203.	1.00	2.6	4.8	21.0	21.0	0.	0.

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20-1330      3.5  14.0 13.1  293.  1.00  2.0  4.6   19.7 19.7  0.44 1.04
20-1430      3.5  14.0 13.1   -    0.40  1.9  4.6   21.0 21.0  0.   0.
20-1530      3.5  14.0 13.0  273.  0.00  1.0  4.6   19.7 19.7  0.44 1.04
20-1630      3.2  14.0 13.3  283.  0.50  1.7  4.6   21.0 21.0  0.   0.
20-1730      3.5  14.0 13.1  238.  0.30  1.0  4.6   21.0 21.0  0.   0.
20-1830      3.0  17.2 13.5  287.  0.00  2.0  4.4   21.0 21.0  0.   0.
20-1930      3.5  14.0 13.1  282.  0.00  2.3  4.8   21.0 21.0  0.   0.
20-2030      3.5  14.0 13.2  258.  0.00  1.7  4.8   21.0 21.0  0.   0.

        SHUT DOWN AT 20-2030 FOR  35 HOURS

22-0030      3.6  13.0 13.0  444.  1.20  1.2  2.7   19.6 19.6  0.81 1.04

        SHUT DOWN AT 22-0030 FOR   2 HOURS

22-1030      3.3  12.7 13.3  323.  0.60  0.7  3.9   19.7 19.7  1.24 0.53
22-1130      3.1  12.7 13.4  253.  2.10  0.4  1.0   19.7 19.7  1.40 0.92
22-1230      3.2  12.7 13.3  252.  0.40  0.6  5.0   21.0 21.0  0.   0.
22-1330      3.2  12.7 13.3  258.  0.40  1.0  5.0   21.0 21.0  0.   0.
22-1430      3.2  12.7 13.3  227.  0.30  1.3  5.4   21.0 21.0  0.   0.
22-1530      3.4  12.7 13.2  242.  0.30  1.6  5.6   21.0 21.0  0.   0.
22-1630      3.3  12.7 13.2  238.  0.30  1.0  6.0   21.0 21.0  0.   0.
22-1730      3.7  12.7 12.9  237.  0.30  1.7  5.0   21.0 21.0  0.   0.
22-1830      4.0  12.4 12.7  232.  0.10  1.5  5.6   21.0 21.0  0.   0.
22-1930      3.2  12.7 13.3  217.  0.         1.7  6.6   21.0 21.0  0.   0.
22-2030      2.9  12.7 13.5  222.  0.         1.3  6.4   21.0 21.0  0.   0.
22-2130      3.6  12.4 13.0  222.  0.         0.7  6.0   21.0 21.0  0.   0.
22-2230      3.6  12.4 13.0  212.  0.         0.9  5.9   21.0 21.0  0.   0.
22-2330      3.4  12.4 13.1  202.  0.         0.6  6.6   21.0 21.3  0.   0.
23-0030      3.6  12.2 13.0  202.  5.00  0.5  4.2   21.0 21.0  0.   0.
23-0130      4.0  12.9 12.7  202.  3.40  0.3  3.9   21.0 21.0  0.   0.
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APPENDIX C: TABLE 5.

RUN 9: GAS COMPOSITIONS PAGE 8 OF 11

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALL	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
23-0230	4.0	12.2	12.7	299.	1.00	0.4	5.4	21.0	21.0	0.	0.
23-0330	4.0	12.7	12.7	247.	1.00	0.4	5.6	21.0	21.0	0.	0.
23-0430	3.6	12.2	13.0	257.	1.00	0.3	5.4	21.0	21.0	0.	0.
23-0530	3.6	14.0	13.0	253.	1.20	0.2	4.6	21.0	21.0	0.	0.
23-0630	3.6	12.2	12.9	303.	0.80	0.3	4.4	19.8	19.8	0.72	0.84
23-0730	3.5	12.2	13.0	292.	0.40	0.3	5.2	19.8	19.8	0.72	0.84
23-0830	3.4	12.4	13.1	283.	0.40	0.1	7.4	21.0	21.0	0.	0.
23-0930	3.3	12.2	13.2	288.	3.00	0.2	5.2	21.0	21.0	0.	0.
23-1030	3.6	12.2	13.0	293.	0.70	0.2	0.7	21.0	21.0	0.	0.
23-1130	3.0	12.7	13.5	288.	1.40	0.2	4.2	21.0	21.0	0.	0.
23-1230	3.0	12.7	13.5	298.	1.10	3.7	6.2	21.0	21.0	0.	0.
23-1330	3.0	12.7	13.5	293.	1.05	0.7	4.0	21.0	21.0	0.	0.
23-1430	3.0	12.7	13.5	353.	1.10	0.5	6.2	21.0	21.0	0.	0.
23-1530	3.2	12.7	13.3	343.	1.10	0.4	5.4	21.0	21.0	0.	0.
23-1630	2.8	12.7	13.6	323.	1.00	2.6	7.0	21.0	21.0	0.	0.
23-1730	3.0	12.7	13.5	313.	1.40	2.8	5.8	21.0	21.0	0.	0.
23-1830	4.3	14.0	12.5	343.	1.70	1.0	5.2	21.0	21.0	0.	0.
23-1930	4.3	14.0	12.5	358.	2.10	0.8	4.6	21.0	21.0	0.	0.
23-2030	4.1	14.0	12.9	363.	1.10	3.7	5.0	21.0	21.0	0.	0.
23-2130	3.8	14.0	12.9	444.	0.	5.2	3.4	21.0	21.0	0.	0.
23-2230	3.6	14.0	13.0	484.	0.	7.5	0.7	21.0	21.0	0.	0.
23-2330	4.0	14.0	12.7	519.	1.00	6.3	0.	21.0	21.0	0.	0.
24-0030	3.4	13.4	13.2	502.	0.10	5.7	0.	21.0	21.0	0.	0.
24-0130	3.4	14.0	13.2	464.	0.10	5.9	0.	21.0	21.0	0.	0.
24-0230	3.4	14.0	13.2	434.	0.	5.3	0.	21.0	21.0	0.	0.
24-0330	2.6	14.0	13.4	434.	0.	5.8	0.3	21.0	21.0	0.	0.
24-0430	3.2	13.4	13.3	394.	0.	7.4	0.3	19.7	19.7	1.41	0.91
24-0530	2.6	12.7	13.7	-	0.	8.0	0.7	19.6	19.6	1.33	0.97

24-0630	3.4	12.4	13.1	394.	0.	6.8	3.3	19.9	19.9	1.57	0.78
24-0730	2.5	13.0	13.8	374.	0.	4.6	6.6	19.8	19.8	1.57	0.80
24-0830	2.6	12.7	13.7	404.	0.	2.2	9.2	19.7	19.7	1.40	0.90
24-0930	2.4	13.2	13.8	415.	5.50	4.9	4.8	19.7	19.7	1.40	0.92
24-1030	2.5	13.2	13.6	374.	0.50	2.9	8.0	21.0	21.0	0.	0.
24-1130	2.6	12.7	13.7	393.	0.	2.2	8.9	21.0	21.0	0.	0.
24-1230	2.9	12.7	13.5	273.	0.	1.9	8.0	21.0	21.0	0.	0.
24-1330	2.5	12.7	13.8	243.	0.	1.7	8.8	21.0	21.0	0.	0.
24-1430	2.4	13.0	13.9	243.	0.	1.4	8.8	21.0	21.0	0.	0.
24-1530	2.1	13.0	14.1	243.	1.00	1.1	8.9	21.0	21.0	0.	0.
24-1630	2.1	13.0	14.1	243.	0.20	1.1	8.0	21.0	21.0	0.	0.
24-1730	2.2	13.2	14.0	243.	0.20	1.1	7.8	21.0	21.0	0.	0.
24-1830	2.5	13.2	13.8	243.	0.	1.1	7.8	21.0	21.0	0.	0.
24-1930	2.7	13.0	13.7	242.	0.	1.0	6.8	21.0	21.0	0.	0.
24-2030	2.9	13.0	13.5	-	0.10	0.9	5.6	21.0	21.0	0.	0.
24-2130	2.9	13.0	13.5	-	0.10	0.9	4.6	21.0	21.0	0.	0.
24-2230	3.2	13.0	13.3	242.	0.40	0.8	4.6	21.0	21.0	0.	0.
24-2330	3.1	12.8	13.3	242.	0.	0.9	8.0	21.0	21.0	0.	0.
25-0030	2.9	13.6	13.5	237.	0.	0.9	7.6	21.0	21.0	0.	0.
25-0130	2.5	13.1	13.8	253.	0.	1.0	7.4	21.0	21.0	0.	0.
25-0230	2.8	13.1	13.6	242.	0.	1.1	7.0	21.0	21.0	0.	0.
25-0330	2.5	13.0	13.8	232.	0.40	1.6	3.1	21.0	21.0	0.	0.
25-0430	2.9	12.7	13.5	247.	0.	3.3	7.4	21.0	21.0	0.	0.
25-0530	2.9	12.7	13.5	247.	0.20	2.2	5.6	21.0	21.0	0.	0.
25-0630	2.9	12.2	13.5	268.	0.	4.2	6.6	0.	19.8	0.01	0.01
25-0730	2.6	12.4	13.7	382.	0.	6.9	3.3	21.0	21.0	0.	0.
25-0830	2.2	13.0	14.1	293.	0.	1.3	0.7	21.0	21.0	0.	0.

SHUT DOWN AT 25-0830 FOR 6 HOURS

25-1430	3.5	12.2	13.0	283.	0.	7.5	4.0	21.0	21.0	0.	0.
25-1530	3.8	14.0	12.8	373.	0.	5.2	5.0	21.0	21.0	0.	0.

APPENDIX B: TABLE V.

RUN 9: GAS COMPOSITIONS PAGE 9 OF 11

DAY-HOUR	FLUE GAS O2 %	CO2 VOL % ANAL	CALC	SO2 PPM	REGENERATOR GAS O2 %	CO2 %	SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	CALC	CO2 VOL % ANAL	CALC
SHUT DOWN AT 25-1530 FOR 7 HOURS											
25-2230	2.2	13.1	14.0	434.	0.	5.3	5.0	21.0	21.0	0.	0.
25-2330	2.2	13.2	14.0	399.	1.00	4.1	4.2	21.0	21.0	0.	0.
26-0030	2.0	13.5	14.2	394.	1.50	3.0	4.2	21.0	21.0	0.	0.
26-0130	1.9	13.5	14.3	374.	1.40	3.0	2.2	21.0	21.0	0.	0.
26-0230	1.5	13.5	14.5	374.	2.00	2.8	2.4	20.4	20.4	0.99	0.42
26-0330	2.1	13.1	14.1	343.	2.00	2.4	2.7	20.4	20.4	0.99	0.42
26-0430	2.1	13.0	14.1	353.	2.90	2.1	1.2	20.4	20.4	0.81	0.41
26-0530	2.1	13.0	14.1	364.	0.50	2.3	7.0	21.0	21.0	0.	0.
26-0630	2.5	13.0	13.8	363.	0.	2.2	7.0	21.0	21.0	0.	0.
26-0730	2.5	13.0	13.8	343.	0.	2.2	7.0	21.0	21.0	0.	0.
26-0830	2.4	13.9	13.9	374.	0.	2.2	7.0	21.0	21.0	0.	0.
SHUT DOWN AT 26-0830 FOR 14 HOURS											
26-2230	2.2	13.5	14.0	363.	0.	1.8	2.0	21.0	21.0	0.	0.
26-2330	2.2	13.5	14.0	383.	0.	1.6	3.9	21.0	21.0	0.	0.
27-0030	2.0	13.0	13.5	217.	0.	-	0.	21.0	21.0	0.	0.
27-0130	2.0	13.0	13.5	217.	0.	2.6	5.8	21.0	21.0	0.	0.
27-0230	3.0	12.7	13.4	229.	0.	1.6	6.4	21.0	21.0	0.	0.
27-0330	3.2	12.4	13.3	182.	0.	1.9	6.0	21.0	21.0	0.	0.
27-0430	3.1	12.6	13.3	172.	0.	3.5	6.2	21.0	21.0	0.	0.
27-0530	3.2	12.7	13.3	162.	0.	2.2	6.0	21.0	21.0	0.	0.
27-0630	3.2	12.4	13.3	162.	0.	2.9	6.2	21.0	21.0	0.	0.
27-0730	3.2	12.4	13.3	172.	0.	4.0	6.2	21.0	21.0	0.	0.
27-0830	2.8	12.7	13.6	229.	0.	-	0.	21.0	21.0	0.	0.
27-0930	2.8	12.7	13.6	237.	0.	2.7	5.8	21.0	21.0	0.	0.
27-1030	3.0	12.4	13.5	232.	0.	1.9	6.2	21.0	21.0	0.	0.
27-1130	3.0	12.4	13.5	-	0.	1.3	5.6	21.0	21.0	0.	0.
27-1230	3.2	12.4	13.3	273.	0.	1.3	6.4	21.0	21.0	0.	0.

27.1330	2.6	12.4	13.7	242.	0.	1.1	8.2	21.0	21.0	0.	0.
27.1430	3.0	12.4	13.5	278.	0.	0.9	7.0	21.0	21.0	0.	0.
27.1530	3.0	12.7	13.4	253.	0.	1.0	7.0	21.0	21.0	0.	0.
27.1630	3.2	12.4	13.3	202.	0.	1.0	6.6	21.0	21.0	0.	0.
27.1730	3.2	12.2	13.4	202.	0.	0.9	6.6	21.0	21.0	0.	0.
27.1830	3.2	12.2	13.3	207.	0.	1.0	6.6	21.0	21.0	0.	0.
27.1930	3.2	12.4	13.3	207.	0.	1.4	6.6	21.0	21.0	0.	0.
27.2030	2.5	13.0	13.0	253.	0.	1.3	6.6	21.0	21.0	0.	0.
27.2130	3.0	12.7	13.5	273.	0.	1.0	6.4	21.0	21.0	0.	0.
27.2230	3.2	12.7	13.3	252.	0.	1.0	6.2	21.0	21.0	0.	0.
27.2330	3.0	12.7	13.4	2[illegible]2.	0.	1.1	6.2	21.0	21.0	0.	0.
28.0030	2.9	12.7	13.5	258.	0.	0.8	6.2	21.0	21.0	0.	0.
28.0130	2.8	13.0	13.6	263.	0.	1.1	6.0	21.0	21.0	0.	0.
28.0230	2.6	13.2	13.7	227.	0.	1.2	5.8	21.0	21.0	0.	0.
28.0330	2.4	13.0	13.9	217.	0.	1.6	6.0	21.0	21.0	0.	0.
28.0430	2.4	13.0	13.9	182.	0.	1.7	6.0	21.0	21.0	0.	0.
28.0530	2.5	13.2	13.8	182.	0.	1.3	6.0	21.0	21.0	0.	0.
28.0630	2.6	13.0	13.8	192.	0.	1.1	6.6	21.0	21.0	0.	0.
28.0730	2.7	13.0	13.7	212.	0.	1.1	6.4	21.0	21.0	0.	5.
28.0830	2.5	13.2	13.8	212.	0.	1.0	6.6	21.0	21.0	0.	0.
28.0930	2.5	13.0	13.8	207.	0.	1.2	6.2	21.0	21.0	0.	0.
28.1030	2.5	13.6	13.8	202.	0.	1.4	6.6	21.0	21.0	0.	0.
28.1130	2.5	13.0	13.8	197.	0.	1.4	6.6	21.0	21.0	0.	0.
28.1230	2.5	13.6	13.8	197.	0.	1.4	6.6	21.0	21.0	0.	0.
28.1330	3.2	12.4	13.3	197.	0.	1.0	6.4	21.0	21.0	0.	0.
28.1430	2.8	12.7	13.6	222.	0.	3.5	5.8	21.0	21.0	0.	0.
28.1530	2.8	12.7	13.6	232.	0.	6.4	4.2	21.0	21.0	0.	0.
28.1630	2.0	13.2	14.2	-	0.	4.3	5.0	21.0	21.0	0.	0.
28.1730	2.4	13.2	13.9	167.	0.	2.5	5.0	21.0	21.0	0.	0.
28.1830	2.2	13.0	14.1	157.	0.40	2.7	5.2	21.0	21.0	0.	0.

APPENDIX G: TABLE 9.

RUN 9: GAS COMPOSITIONS PAGE 10 OF 11

DAY-HOUR	FLUE GAS O2 %	FLUE GAS CO2 VOL % ANAL	FLUE GAS CO2 VOL % CALC	FLUE GAS SO2 PPM	REGENERATOR GAS O2 %	REGENERATOR GAS CO2 %	REGENERATOR GAS SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	GASIFIER INLET GAS O2 VOL % CALC	GASIFIER INLET GAS CO2 VOL % ANAL	GASIFIER INLET GAS CO2 VOL % CALC
28-1930	2.2	13.0	14.1	162.	0.	2.1	6.2	21.0	21.0	0.	0.
28-2030	2.2	13.0	14.1	162.	0.50	1.6	6.6	21.0	21.0	0.	0.
28-2130	2.2	13.0	14.1	152.	0.	3.0	6.4	21.0	21.0	0.	0.
28-2230	2.8	13.9	13.6	182.	0.	0.1	2.9	21.0	21.0	0.	0.
SHUT DOWN AT 28-2230 FOR 24 HOURS											
29-2330	2.9	13.5	13.5	-	0.20	0.8	4.0	14.6	18.4	0.	1.95
30-0030	2.9	13.2	13.5	606.	0.	0.4	5.3	14.3	18.6	0.	1.38
30-0130	2.9	13.0	13.5	535.	0.	0.4	5.4	14.2	18.2	0.	1.97
SHUT DOWN AT 30-0130 FOR 3 HOURS											
30-0430	2.7	13.0	13.7	666.	0.12	0.3	5.0	13.7	17.6	1.83	2.40
30-0530	3.2	12.7	13.3	651.	0.10	0.3	4.8	13.5	16.4	2.12	3.25
30-0630	2.8	13.2	13.6	484.	0.10	1.0	4.6	21.0	21.0	0.	0.
30-0730	3.8	12.7	12.8	323.	0.	1.7	4.8	21.0	21.0	0.	0.
30-0830	3.7	12.7	12.9	222.	0.	1.4	4.6	21.0	21.0	0.	0.
30-0930	3.6	12.2	13.0	-	0.	1.4	5.0	21.0	21.0	0.	0.
30-1030	3.6	12.2	13.0	167.	0.	2.1	5.6	21.0	21.0	0.	0.
30-1130	3.6	12.4	13.0	187.	0.	1.5	6.0	21.0	21.0	0.	0.
30-1230	3.5	12.4	13.1	202.	0.	1.3	6.2	21.0	21.0	0.	0.
30-1330	3.5	12.2	13.1	222.	0.	1.3	6.6	21.0	21.0	0.	0.
30-1430	3.6	12.2	13.0	232.	0.	1.6	6.4	21.0	21.0	0.	0.
30-1530	3.9	14.0	12.8	242.	0.	1.4	6.2	21.0	21.0	0.	0.
30-1630	3.6	14.0	13.0	257.	0.	1.4	6.2	21.0	21.0	0.	0.
30-1730	3.6	14.0	13.0	268.	0.	1.4	6.2	21.0	21.0	0.	0.
30-1830	3.8	14.0	12.8	303.	0.	0.8	6.6	21.0	21.0	0.	0.
30-1930	3.8	14.0	12.8	323.	0.	0.8	6.4	21.0	21.0	0.	0.
30-2030	3.9	14.0	12.8	343.	0.	0.8	6.4	21.0	21.0	0.	0.
30-2130	3.8	14.0	12.9	383.	0.	0.9	6.2	21.0	21.0	0.	0.
30-2230	3.7	12.7	12.9	565.	0.20	0.5	5.2	19.7	19.7	1.40	0.95

30-2330	2.2	12.7	14.1	545.	0.50	1.2	5.0	21.0	21.0	0.	0.
31-0030	2.2	13.0	14.1	545.	0.20	1.3	5.2	21.0	21.0	0.	0.
31-0130	2.2	13.0	14.1	464.	0.10	2.4	4.8	21.0	21.0	0.	0.
31-0230	2.2	13.0	14.1	343.	0.	2.3	5.6	21.0	21.0	0.	0.
31-0330	3.5	12.4	13.1	353.	0.	1.6	5.4	21.0	21.0	0.	0.
31-0430	3.5	12.4	13.1	363.	0.50	2.9	4.6	19.7	19.7	1.40	0.92
31-0530	4.2	14.0	12.5	363.	0.	3.1	6.2	18.2	18.2	1.40	2.33
31-0630	4.2	14.0	12.5	328.	0.	1.9	6.0	21.0	21.0	0.	0.
31-0730	3.9	14.0	12.8	262.	0.	2.3	5.8	21.0	21.0	0.	0.
31-0830	4.0	14.0	12.7	272.	0.	2.0	6.2	21.0	21.0	0.	0.
31-0930	4.3	14.0	12.7	283.	0.	2.2	6.2	21.0	21.0	0.	0.
31-1030	3.2	12.4	13.3	283.	0.	2.1	5.8	21.0	21.0	0.	0.
31-1130	4.0	12.2	12.7	253.	0.	1.7	6.4	21.0	21.0	0.	0.
31-1230	3.8	14.0	12.9	343.	0.	1.7	6.4	21.0	21.0	0.	0.
31-1330	3.9	14.0	12.8	403.	0.	1.7	5.4	21.0	21.0	0.	0.
31-1430	3.9	14.0	12.8	424.	0.	-	0.	21.0	21.0	0.	0.
31-1530	3.9	14.0	12.8	404.	0.	-	0.	21.0	21.0	0.	0.
31-1630	3.5	12.4	12.9	454.	0.	-	0.	18.2	18.2	2.12	1.99
31-1730	3.5	12.4	13.0	293.	0.	0.3	5.2	18.2	18.2	2.12	1.99
31-1830	3.5	12.4	13.1	343.	0.	0.5	4.6	18.2	18.2	2.12	1.99
31-1930	3.3	12.4	13.2	252.	0.	1.1	3.9	21.0	21.0	0.	0.
			STONE CHARGE								
31-2030	3.3	12.4	13.2	227.	0.	0.6	4.2	21.0	21.0	0.	0.
31-2130	3.0	12.7	13.4	227.	0.	0.8	5.0	21.0	21.0	0.	0.
31-2230	2.9	12.7	13.5	227.	0.	1.1	5.0	21.0	21.0	0.	0.
31-2330	2.6	13.0	13.8	227.	0.	1.1	5.6	21.0	21.0	0.	0.
32-0030	2.9	12.7	13.6	227.	0.50	1.3	6.0	21.0	21.0	0.	0.
32-0130	3.0	12.7	13.5	227.	0.10	1.3	5.8	21.0	21.0	0.	0.
32-0230	3.1	12.7	13.4	292.	0.30	1.0	5.6	21.0	21.0	0.	0.
32-0330	3.4	12.4	12.9	212.	0.20	0.6	5.4	21.0	21.0	0.	0.

APPENDIX C: TABLE 9.

RUN 9: GAS COMPOSITIONS PAGE 11 OF 11

DAY-HOUR	FLUE GAS O2 %	 CO2 VOL % ANAL	 CALC	 SO2 PPM	REGENERATOR GAS O2 %	 CO2 %	 SO2 %	GASIFIER INLET GAS O2 VOL % ANAL	 CALC	 CO2 VOL % ANAL	 CALC
30-0430	3.5	12.4	13.1	212.	0.10	1.0	5.8	21.0	21.0	0.	0.
30-0530	3.5	12.2	13.1	222.	1.00	1.2	5.0	21.0	21.0	0.	0.
30-0630	3.1	12.4	13.4	212.	4.50	1.6	4.6	21.0	21.0	0.	0.
30-0730	3.9	14.0	12.8	222.	4.50	1.8	4.0	21.0	21.0	0.	0.
30-0830	4.0	14.0	12.7	217.	4.50	1.3	2.0	21.0	21.0	0.	0.

APPENDIX Q: TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 1 OF 11

	TOTAL SULPHUR KILOMOLS					EQUIVALENT BURNT STONE KILOGRAMS		
DAY-HOUR	IN	FLUE	REGEN	FINES	IN-OUT	FEED	REMOVED	IN-OUT
1-1930	0.120	0.017	0.027	0.001	0.054	1.3	0.7	0.6
1-2030	0.254	0.037	0.048	0.001	0.158	2.6	1.5	1.1
1-2130	0.398	0.054	0.068	0.002	0.275	5.3	2.2	3.1
SHUT DOWN AT 1-2130 FOR 4 HOURS								
2-0230	0.518	0.107	0.092	0.002	0.321	5.3	3.0	2.3
2-0330	0.651	0.162	0.113	0.003	0.373	15.8	3.7	12.1
2-0430	0.780	0.206	0.140	0.003	0.406	31.1	4.4	26.7
2-0530	0.918	0.247	0.191	0.004	0.476	45.4	5.2	40.2
2-0630	1.041	0.278	0.224	0.005	0.535	58.3	6.3	52.1
2-0730	1.172	0.311	0.256	0.006	0.600	73.1	7.7	65.4
2-0830	-	-	-	-	-	75.2	9.1	66.1
2-0930	-	-	-	-	-	76.8	10.5	66.3
2-1030	1.314	0.359	0.342	0.007	0.606	78.6	11.9	66.7
2-1130	1.462	0.410	0.419	0.008	0.625	80.8	13.3	67.4
2-1230	1.611	0.462	0.499	0.009	0.641	82.9	14.8	68.1
2-1330	1.760	0.516	0.579	0.010	0.654	85.5	16.2	69.3
2-1430	1.912	0.576	0.667	0.011	0.658	88.1	17.6	70.6
2-1530	2.065	0.642	0.748	0.012	0.662	95.8	19.0	76.8
2-1630	2.218	0.696	0.825	0.014	0.683	102.9	20.4	82.5
2-1730	2.371	0.745	0.902	0.017	0.706	118.5	23.6	94.9
2-1830	2.518	0.791	0.987	0.021	0.720	128.8	27.2	101.6
2-1930	2.669	0.835	1.075	0.026	0.733	135.9	32.9	103.0
2-2030	2.818	0.878	1.165	0.032	0.743	154.4	38.6	115.8
2-2130	2.964	0.923	1.256	0.038	0.750	162.0	44.3	117.7
2-2230	3.115	0.964	1.355	0.044	0.752	168.6	50.1	118.6
2-2330	3.266	1.014	1.452	0.050	0.750	176.8	55.8	121.0
SHUT DOWN AT 2-2330 FOR 28 HOURS								
4-0430	-	-	-	-	-	178.9	61.5	117.4

4·0530	-	-	-	-	-	186·0	63·6	122·0
4·0630	3·394	1·095	1·530	0·052	0·709	197·1	65·8	131·0
4·0730	3·509	1·121	1·622	0·054	0·723	214·6	67·9	146·7
4·0830	3·647	1·146	1·704	0·056	0·742	223·2	70·0	153·0
4·0930	3·774	1·169	1·777	0·058	0·765	240·7	72·1	168·5

SHUT DOWN AT 4·0930 FOR 2 HOURS

4·1130	3·907	1·196	1·777	0·060	0·874	242·3	74·3	168·0
4·1230	4·025	1·227	1·777	0·062	0·962	249·1	76·4	172·7
4·1330	4·141	1·259	1·777	0·064	1·041	257·6	78·5	179·0
4·1430	4·256	1·289	1·777	0·066	1·123	267·6	80·6	186·9
4·1530	4·371	1·317	1·865	0·068	1·121	271·3	82·9	188·3
4·1630	4·486	1·350	1·948	0·072	1·115	273·4	86·3	187·1
4·1730	4·601	1·386	2·023	0·075	1·117	276·6	89·0	187·6
4·1830	4·716	1·421	2·095	0·078	1·122	289·0	91·8	197·9
4·1930	4·831	1·451	2·166	0·082	1·132	308·5	96·0	212·5
4·2030	4·946	1·481	2·229	0·091	1·145	328·0	103·5	224·5
4·2130	5·062	1·510	2·298	0·095	1·159	341·8	107·0	234·7
4·2230	5·175	1·537	2·372	0·101	1·165	347·0	112·3	224·8
4·2330	5·290	1·563	2·434	0·105	1·180	364·7	115·6	240·1
5·0030	5·408	1·591	2·506	0·108	1·183	373·2	118·6	254·5
5·0130	5·522	1·620	2·583	0·111	1·200	387·9	121·6	266·4
5·0230	5·633	1·651	2·662	0·114	1·207	395·5	124·5	273·9
5·0330	5·749	1·680	2·737	0·145	1·187	409·3	144·9	264·4
5·0430	5·863	1·703	2·803	0·148	1·208	424·4	147·9	276·5
5·0530	5·977	1·725	2·876	0·154	1·222	431·2	152·6	278·6
5·0630	6·091	1·751	2·931	0·157	1·252	448·4	155·7	292·7
5·0730	6·206	1·774	2·995	0·161	1·276	468·8	159·0	301·8

APPENDIX 8. TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 2 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLS					EQUIVALENT BURNT STONE KILOGRAMS		
	IN	FLUE	REGEN	FINES	IN-OUT	FEED	REMOVED	IN-OUT
5-0830	6.318	1.796	3.054	0.165	1.303	472.1	162.3	309.8
5-0930	6.432	1.817	3.116	0.169	1.330	486.1	165.5	320.6
5-1030	6.547	1.838	3.176	0.179	1.354	494.8	173.0	321.8
5-1130	6.661	1.858	3.234	0.209	1.360	508.8	192.8	316.0
5-1230	6.772	1.878	3.305	0.222	1.365	522.0	202.5	319.5
5-1330	6.886	1.898	3.392	0.239	1.356	536.8	215.0	321.8
5-1430	7.000	1.920	3.476	0.251	1.349	551.6	223.9	327.7
5-1530	7.115	1.947	3.560	0.263	1.345	566.8	231.9	334.9
5-1630	7.229	1.969	3.642	0.275	1.343	578.5	240.9	337.6
5-1730	7.344	1.991	3.712	0.287	1.354	583.9	249.2	334.7
5-1830	7.458	2.018	3.783	0.304	1.353	598.9	260.1	338.8
5-1930	7.573	2.047	3.853	0.313	1.361	601.7	266.0	335.7
5-2030	7.688	2.074	3.914	0.320	1.381	620.2	274.9	345.3
5-2130	7.806	2.096	3.979	0.335	1.396	646.3	281.0	365.3
5-2230	7.917	2.119	4.052	0.354	1.392	667.4	292.8	374.6
5-2330	8.032	2.141	4.129	0.376	1.386	686.2	307.3	378.9
6-0030	8.146	2.161	4.199	0.394	1.392	703.3	319.2	384.1
6-0130	8.261	2.181	4.268	0.410	1.401	722.6	330.5	392.1
6-0230	8.375	2.201	4.338	0.427	1.409	745.5	342.1	403.4
6-0330	8.490	2.222	4.403	0.443	1.422	768.7	353.8	414.9
6-0430	8.604	2.242	4.465	0.459	1.438	792.8	364.9	427.9
6-0530	8.719	2.261	4.530	0.475	1.453	819.4	376.9	442.5
6-0630	8.834	2.278	4.596	0.495	1.465	847.9	391.2	456.7
6-0730	8.946	2.292	4.663	0.517	1.474	874.0	405.7	468.3
6-0830	9.061	2.309	4.729	0.532	1.490	905.7	417.5	488.2
6-0930	9.174	2.323	4.810	0.546	1.495	930.2	427.9	502.3
6-1030	-	-	-	-	-	956.9	451.2	505.7
6-1130	9.290	2.347	4.877	0.559	1.506	979.1	461.4	517.6

6-1230	9.404	2.368	4.945	0.576	1.515	1015.2	475.7	539.5
6-1330	9.524	2.387	5.022	0.595	1.520	1040.1	492.2	547.9
6-1430	9.639	2.406	5.104	0.614	1.515	1072.0	508.7	563.3
6-1530	9.752	2.422	5.161	0.635	1.535	1089.9	523.7	566.2
6-1630	9.865	2.439	5.230	0.648	1.540	1100.8	533.2	567.6
6-1730	9.985	2.458	5.230	0.652	1.644	1122.1	537.3	584.8
6-1830	10.100	2.476	5.230	0.657	1.736	1135.0	541.4	593.6
6-1930	10.211	2.498	5.230	0.696	1.787	1135.0	566.2	568.8
6-2030	10.323	2.522	5.230	0.734	1.837	1135.0	589.9	545.1

SHUT DOWN AT 6-2030 FOR 4 HOURS

7-0130	-	-	-	-	-	1135.0	607.3	527.7
7-0230	10.458	2.552	5.346	0.739	1.821	1135.6	612.5	523.1
7-0330	10.593	2.578	5.435	0.745	1.834	1142.4	617.7	524.7
7-0430	10.728	2.611	5.540	0.751	1.817	1149.8	622.9	526.9
7-0530	10.863	2.643	5.650	0.756	1.813	1160.9	628.1	532.8
7-0630	10.996	2.671	5.740	0.773	1.804	1168.3	639.4	528.9
7-0730	11.132	2.699	5.843	0.789	1.802	1175.7	650.1	525.6
7-0830	11.267	2.727	5.935	0.802	1.803	1186.0	659.6	526.4
7-0930	11.407	2.756	6.232	0.813	1.806	1194.7	667.8	526.9
7-1030	11.538	2.784	6.117	0.861	1.776	1198.6	698.2	500.4
7-1130	11.672	2.812	6.201	0.849	1.789	1201.8	703.7	498.1
7-1230	11.808	2.843	6.255	0.876	1.804	1205.2	709.3	495.9
7-1330	11.942	2.875	6.365	0.884	1.819	1212.6	714.9	497.7
7-1430	12.077	2.905	6.442	0.896	1.834	1222.6	723.6	499.0
7-1530	12.211	2.937	6.499	0.903	1.872	1265.9	729.2	536.7
7-1630	12.342	2.966	6.576	0.912	1.890	1299.2	735.7	563.5
7-1730	12.475	2.985	6.648	0.922	1.919	1330.1	744.0	586.1
7-1830	12.601	3.003	6.721	0.931	1.947	1357.0	750.3	606.7
7-1930	12.724	3.019	6.802	0.938	1.965	1374.9	756.0	618.9
7-2030	-	-	-	-	-	1414.8	766.3	648.5
7-2130	-	-	-	-	-	1426.1	776.7	649.4
7-2230	12.848	3.028	6.921	0.946	1.953	1437.2	782.6	654.6
7-2330	12.968	3.042	7.031	0.973	1.922	1448.5	803.2	645.3

APPENDIX 6c TABLE VI.
RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 3 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
8-0030	13.091	3.056	7.143	0.985	1.906	1460.7	813.1	647.6
8-0130	13.213	3.070	7.246	0.994	1.903	1471.0	820.4	650.6
8-0230	13.339	3.084	7.349	1.003	1.904	1480.7	827.7	653.0
8-0330	13.468	3.099	7.452	1.011	1.906	1492.4	835.0	657.4
8-0430	13.596	3.114	7.556	1.020	1.907	1500.3	842.3	658.0
8-0530	13.724	3.129	7.657	1.032	1.907	1508.7	852.2	656.5
8-0630	13.852	3.144	7.760	1.040	1.909	1519.0	859.5	659.5
8-0730	13.983	3.160	7.888	1.048	1.887	1529.3	866.8	662.5
8-0830	14.110	3.177	7.988	1.051	1.893	1541.2	869.7	671.5
8-0930	14.241	3.194	8.095	1.062	1.896	1549.4	879.7	669.7
8-1030	14.373	3.211	8.196	1.077	1.889	1559.1	891.8	667.3
8-1130	14.499	3.226	8.299	1.099	1.874	1575.5	910.6	664.9
8-1230	-	-	-	-	-	1590.8	919.6	671.2
8-1330	14.626	3.242	8.401	1.106	1.886	1605.0	925.5	679.5
8-1430	14.766	3.256	8.505	1.119	1.886	1620.8	935.8	685.0
8-1530	14.896	3.271	8.612	1.133	1.879	1631.7	947.2	684.5
8-1630	15.025	3.289	8.665	1.149	1.922	1644.8	959.8	685.0
8-1730	15.154	3.306	8.769	1.172	1.907	1655.2	977.7	677.5
8-1830	15.285	3.321	8.851	1.186	1.927	1668.9	988.7	680.2
8-1930	15.413	3.337	8.948	1.199	1.930	1682.4	998.3	684.1
8-2030	15.544	3.348	9.049	1.215	1.932	1692.9	1010.5	682.4
8-2130	15.673	3.358	9.149	1.241	1.925	1705.3	1030.7	674.6

SHUT DOWN AT 8-2130 FOR 8 HOURS

DAY-HOUR	IN	FLUE	REGEN	FINES	IN-OUT	FEED	REMOVED	IN-OUT
9-0630	15.803	3.380	9.247	1.252	1.924	1711.4	1038.9	672.5
9-0730	15.933	3.402	9.352	1.271	1.907	1717.7	1053.7	664.0
9-0830	16.063	3.424	9.450	1.281	1.909	1721.9	1061.4	660.5
9-0930	16.193	3.445	9.547	1.290	1.911	1730.1	1068.3	661.8
9-1030	16.322	3.463	9.652	1.299	1.909	1742.8	1075.3	667.5

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9.1130   16.452    3.481    9.756   1.324   1.891    1750.7   1093.7    657.0
9.1230     -         -        -       -       -      1758.6   1100.1    658.5
9.1330   16.523    3.500    9.854   1.331   1.896    1770.7   1106.1    663.6
9.1430   16.712    3.518    9.958   1.336   1.900    1782.6   1110.4    672.3
9.1530   16.842    3.536   10.058   1.347   1.902    1800.3   1115.4    682.0
9.1630   16.973    3.555   10.162   1.350   1.905    1814.0   1121.5    692.6
9.1730   17.100    3.573   10.263   1.361   1.904    1823.0   1130.7    692.7
9.1830   17.226    3.589   10.354   1.375   1.908    1835.7   1145.0    693.7
9.1930   17.352    3.605   10.448   1.386   1.913    1848.4   1150.5    698.9
9.2030   17.481    3.622   10.546   1.394   1.920    1861.5   1157.4    704.2

         SHUT DOWN AT  9.2030 FOR   5 HOURS

10.0230    -         -        -       -       -      1865.2   1164.1    701.2
10.0330  17.619    3.641   10.638   1.402   1.939    1869.2   1165.9    699.3
10.0430  17.746    3.664   10.729   1.408   1.947    1874.2   1174.9    699.3
10.0530  17.877    3.684   10.820   1.421   1.947    1885.3   1185.3    700.0
10.0630  18.006    3.702   10.924   1.428   1.953    1901.4   1190.3    711.1
10.0730  18.136    3.719   11.029   1.440   1.947    1906.3   1200.0    708.3
10.0830  18.264    3.735   11.130   1.457   1.942    1922.8   1213.2    709.6
10.0930  18.395    3.752   11.200   1.463   1.979    1932.8   1218.1    714.7
10.1030  18.521    3.767   11.289   1.469   2.016    1943.1   1222.7    720.4
10.1130  18.650    3.782   11.376   1.486   2.006    1953.7   1236.6    717.1
10.1230  18.778    3.800   11.481   1.491   2.006    1963.9   1240.7    723.3
10.1330  18.908    3.818   11.594   1.501   1.995    1972.9   1248.7    724.2
10.1430  19.036    3.835   11.784   1.513   1.983    1983.2   1258.5    724.7
10.1530  19.166    3.854   11.880   1.518   1.996    1991.7   1262.1    729.6
10.1630  19.294    3.871   11.983   1.527   1.993    2000.6   1270.0    730.6
10.1730  19.420    3.889   12.005   1.546   1.981    2011.7   1285.7    726.6
10.1830  19.553    3.907   12.115   1.556   1.975    2021.2   1293.9    727.3
10.1930  19.681    3.925   12.224   1.560   1.971    2027.8   1297.8    730.8
10.2030  19.809    3.944   12.332   1.565   1.969    2033.6   1301.6    732.1
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APPENDIX G: TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 4 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
10-2130	19.942	3.963	12.436	1.574	1.969	2044.7	1309.7	735.0
10-2230	20.070	3.981	12.539	1.582	1.968	2052.9	1317.0	735.9
10-2330	20.198	4.000	12.645	1.600	1.954	2061.6	1332.7	728.9
11-0030	20.326	4.018	12.747	1.615	1.946	2076.1	1345.6	730.5
11-0130	20.454	4.037	12.851	1.629	1.936	2085.9	1358.4	727.5
11-0230	20.583	4.056	12.956	1.645	1.926	2094.3	1371.2	723.1
11-0330	-	-	-	-	-	2102.2	1388.9	713.4
11-0430	20.711	4.076	13.063	1.640	1.923	2111.5	1392.5	718.9
11-0530	20.839	4.095	13.165	1.653	1.922	2119.6	1396.2	723.4
11-0630	20.967	4.122	13.211	1.657	1.977	2125.7	1399.6	726.2
11-0730	21.095	4.148	13.283	1.672	1.993	2141.8	1411.4	730.4
11-0830	21.223	4.170	13.338	1.687	2.028	2150.3	1423.1	727.1
11-0930	21.352	4.190	13.421	1.702	2.030	2162.7	1434.7	728.0
11-1030	21.481	4.209	13.528	1.718	2.016	2172.2	1446.2	726.0
11-1130	21.609	4.227	13.665	1.744	1.974	2183.2	1465.1	718.1
11-1230	21.738	4.245	13.782	1.747	1.964	2193.8	1467.8	726.0
11-1330	21.867	4.263	13.908	1.750	1.946	2201.7	1470.7	731.0
11-1430	21.992	4.281	14.002	1.754	1.955	2211.5	1474.0	737.5
11-1530	22.121	4.298	14.102	1.757	1.963	2221.8	1476.8	744.2
11-1630	22.246	4.318	14.201	1.767	1.961	2230.5	1484.1	746.4
11-1730	22.371	4.338	14.291	1.784	1.958	2242.1	1497.1	745.0
11-1830	22.499	4.359	14.376	1.795	1.970	2251.6	1505.4	746.2
11-1930	22.626	4.377	14.464	1.807	1.979	2261.9	1514.2	747.7
11-2030	22.757	4.397	14.557	1.818	1.985	2272.2	1522.9	749.3
11-2130	22.881	4.415	14.642	1.831	1.993	2282.2	1532.7	749.5
11-2230	23.010	4.434	14.734	1.844	1.998	2290.1	1542.6	747.5
11-2330	23.138	4.452	14.828	1.859	1.999	2295.9	1554.1	741.9
12-0030	23.262	4.472	14.920	1.871	1.998	2306.0	1563.1	742.9

12-0130	23-377	4-489	15-015	1-874	2-000	2318-6	1565-0	753-6
12-0230	23-486	4-505	15-102	1-892	1-999	2327-1	1571-4	755-7
12-0330	23-603	4-523	15-192	1-898	1-998	2336-0	1578-0	758-1
12-0430	23-718	4-542	15-237	1-905	2-034	2345-0	1589-5	755-5
12-0530	23-833	4-562	15-286	1-915	2-049	2350-2	1591-7	755-5
12-0630	23-947	4-578	15-360	1-923	2-066	2360-6	1604-3	756-3
12-0730	24-062	4-592	15-458	1-930	2-051	2366-7	1610-7	756-0
12-0830	-	-	-	-	-	2372-2	1612-5	759-7
12-0930	-	-	-	-	-	2376-5	1615-7	760-8
12-1030	24-177	4-609	15-553	1-933	2-082	2384-6	1617-5	767-1
12-1130	24-291	4-625	15-646	1-939	2-081	2388-0	1622-7	765-3
12-1230	24-407	4-642	15-755	1-942	2-049	2390-1	1624-7	765-5
12-1330	24-523	4-660	15-865	1-945	2-054	2394-4	1626-9	767-4
12-1430	24-642	4-678	15-967	1-948	2-049	2395-6	1629-2	768-4
12-1530	24-760	4-697	16-066	1-951	2-047	2402-8	1631-5	771-3
12-1630	24-880	4-716	16-157	1-953	2-054	2407-0	1633-2	773-0
12-1730	24-999	4-735	16-247	1-958	2-059	2410-2	1637-6	772-6
12-1830	25-119	4-754	16-337	1-961	2-067	2412-8	1639-6	773-3
12-1930	25-238	4-774	16-426	1-964	2-075	2415-2	1640-5	772-6
12-2030	25-358	4-793	16-515	1-966	2-083	2416-3	1640-7	772-6
12-2130	25-479	4-815	16-610	1-969	2-086	2416-5	1645-7	778-8
12-2230	25-599	4-837	16-699	1-972	2-090	2420-8	1647-8	773-0
12-2330	25-718	4-861	16-787	1-979	2-091	2424-7	1653-9	778-9
13-0030	25-839	4-885	16-875	1-982	2-097	2429-5	1655-9	773-5
13-0130	25-958	4-909	16-956	1-985	2-105	2432-4	1658-0	774-3
13-0230	26-077	4-932	17-033	1-988	2-124	2436-4	1660-1	778-4
13-0330	26-197	4-956	17-111	1-991	2-138	2439-5	1662-0	777-5
13-0430	26-318	4-982	17-152	1-994	2-198	2443-4	1663-9	779-6
13-0530	26-438	5-008	17-188	1-997	2-246	2446-7	1665-8	781-1
13-0630	26-558	5-037	17-225	2-000	2-294	2450-0	1667-6	782-5
13-0730	26-674	5-065	17-313	2-002	2-294	2450-7	1669-1	783-6
13-0830	26-794	5-092	17-366	2-004	2-331	2455-6	1670-6	785-0
13-0930	26-917	5-120	17-403	2-007	2-367	2458-2	1672-1	786-2

APPENDIX G, TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE.   PAGE 5 OF 11

SHUT DOWN AT 13-1130 FOR 13 HOURS

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
14-0130	27.273	5.208	17.699	2.054	2.312	2474.3	1704.3	770.0
14-0230	27.395	5.238	17.784	2.060	2.313	2483.0	1707.9	775.2
14-0330	27.507	5.263	17.860	2.065	2.319	2497.0	1711.4	785.6
14-0430	27.629	5.290	17.935	2.071	2.333	2504.4	1714.9	789.5
14-0530	27.753	5.317	17.987	2.077	2.372	2510.5	1718.5	792.0
14-0630	27.870	5.341	18.034	2.081	2.414	2520.2	1721.1	799.2
14-0730	27.989	5.367	18.069	2.083	2.469	2530.8	1722.7	808.1
14-0830	28.099	5.393	18.116	2.086	2.504	2540.0	1724.3	815.7
14-0930	28.211	5.418	18.142	2.089	2.562	2545.3	1725.9	819.4
14-1030	28.328	5.443	18.147	2.091	2.647	2548.5	1727.5	821.0
14-1130	28.445	5.466	18.160	2.104	2.715	2551.9	1733.6	818.3
14-1230	28.562	5.488	18.207	2.106	2.761	2555.6	1735.3	820.3
14-1330	28.676	5.510	18.340	2.108	2.718	2560.1	1736.8	823.3
14-1430	28.791	5.535	18.449	2.111	2.696	2563.0	1738.2	824.8
14-1530	28.908	5.560	18.560	2.113	2.675	2565.9	1739.6	826.3
14-1630	29.026	5.586	18.669	2.115	2.656	2569.3	1741.1	828.2
14-1730	29.147	5.613	18.769	2.122	2.644	2574.3	1745.2	829.2
14-1830	29.267	5.640	18.848	2.124	2.656	2579.6	1746.5	833.1
14-1930	29.385	5.665	18.942	2.126	2.652	2584.9	1747.8	837.1
14-2030	29.502	5.688	19.037	2.128	2.649	2590.7	1749.1	841.6
14-2130	29.622	5.710	19.127	2.130	2.654	2595.5	1750.4	845.1
14-2230	-	-	-	-	-	2600.5	1751.7	848.8
14-2330	29.735	5.734	19.221	2.162	2.618	2605.2	1774.3	830.9
15-0030	29.850	5.760	19.307	2.164	2.620	2610.8	1775.5	835.2
15-0130	29.970	5.785	19.393	2.165	2.627	2616.3	1776.6	839.7
15-0230	30.086	5.811	19.478	2.167	2.630	2621.6	1777.7	843.9
15-0330	30.203	5.836	19.561	2.169	2.637	2625.0	1778.7	846.3

15-0430	30-321	5-861	19-655	2-170	2-636	2627-9	1779-8	848-1
15-0530	30-439	5-885	19-734	2-172	2-649	2630-6	1780-9	849-7
15-0630	30-555	5-909	19-819	2-173	2-653	2633-2	1781-9	851-3
15-0730	30-672	5-940	19-905	2-177	2-659	2635-3	1784-8	850-5
15-0830	30-787	5-963	19-981	2-179	2-664	2639-5	1795-9	852-6
15-0930	30-907	5-988	20-070	2-226	2-624	2644-5	1824-8	830-6
15-1030	31-021	6-011	20-149	2-227	2-634	2648-8	1825-2	824-6
15-1130	31-138	6-035	20-239	2-234	2-638	2653-5	1829-9	823-6
15-1230	31-254	6-059	20-320	2-237	2-639	2656-9	1830-3	824-6
15-1330	31-370	6-084	20-405	2-240	2-640	2661-2	1835-5	825-7
15-1430	31-486	6-111	20-490	2-244	2-640	2664-6	1838-7	825-9
15-1530	31-601	6-135	20-581	2-248	2-637	2668-7	1841-9	826-4
15-1630	31-717	6-161	20-664	2-252	2-639	2672-2	1845-1	827-1

SHUT DOWN AT 15-1630 FOR 14 HOURS

16-0730	31-832	6-189	20-766	2-256	2-621	2663-9	1849-3	835-5
16-0830	31-946	6-216	20-864	2-266	2-681	2673-9	1855-1	838-7
16-0930	32-064	6-242	20-944	2-269	2-689	2705-0	1857-6	847-4
16-1030	32-180	6-265	21-043	2-272	2-680	2717-6	1860-0	857-6
16-1130	32-296	6-288	21-146	2-275	2-587	2725-6	1862-4	863-1
16-1230	-	-	-	-	-	2729-3	1864-8	864-4
16-1330	32-413	6-316	21-252	2-278	2-566	2733-2	1867-2	866-8
16-1430	32-529	6-346	21-354	2-286	2-543	2736-4	1872-7	862-7
16-1529	32-646	6-376	21-453	2-290	2-527	2739-5	1875-6	864-2

SHUT DOWN AT 16-1530 FOR 2 HOURS

16-1730	32-758	6-419	21-461	2-295	2-592	2740-7	1879-1	868-6
16-1830	32-874	6-448	21-542	3-299	2-594	2757-6	1882-5	875-3
16-1930	32-977	6-464	21-634	2-304	2-575	2762-0	1885-9	876-1

APPENDIX 5. TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 6 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
16-2030	33.081	6.491	21.722	2.307	2.561	2765.1	1888.0	877.2
16-2130	33.186	6.520	21.808	2.309	2.549	2768.3	1889.6	878.8
16-2230	33.289	6.548	21.888	2.311	2.541	2770.7	1891.1	879.5
16-2330	33.392	6.575	21.970	2.328	2.519	2773.3	1893.3	880.0
SHUT DOWN AT 16-2330 FOR 3 HOURS								
17-0330	33.492	6.607	22.050	2.330	2.505	2777.3	1904.9	872.4
17-0430	33.627	6.655	22.122	2.337	2.513	2781.0	1910.6	870.4
17-0530	33.760	6.703	22.195	2.345	2.517	2784.7	1916.2	868.5
17-0630	33.896	6.746	22.273	2.351	2.526	2788.4	1920.5	867.8
17-0730	34.032	6.787	22.343	2.360	2.542	2791.5	1927.5	864.0
17-0830	34.166	6.828	22.415	2.364	2.556	2794.4	1930.8	863.6
17-0930	34.297	6.871	22.487	2.369	2.569	2798.1	1934.6	863.5
17-1030	34.425	6.912	22.553	2.374	2.585	2802.4	1938.4	864.0
17-1130	34.565	6.951	22.634	2.379	2.601	2806.8	1941.9	864.9
17-1230	34.699	6.994	22.711	2.388	2.607	2811.1	1948.2	862.8
17-1330	34.834	7.034	22.802	2.392	2.606	2814.2	1951.4	862.8
17-1430	34.968	7.071	22.891	2.397	2.609	2817.7	1954.7	863.0
17-1530	35.103	7.111	22.983	2.406	2.602	2820.6	1961.0	859.6
17-1630	35.237	7.156	23.067	2.412	2.601	2822.9	1965.1	857.8
17-1730	35.372	7.199	23.144	2.419	2.610	2852.2	1969.5	882.8
17-1830	35.526	7.235	23.238	2.427	2.627	2857.5	1974.5	883.0
17-1930	35.683	7.275	23.332	2.445	2.631	2865.2	1985.5	879.7
17-2030	35.840	7.316	23.445	2.451	2.627	2869.4	1989.0	880.4
17-2130	35.996	7.363	23.559	2.457	2.617	2874.9	1992.4	882.5
17-2230	36.155	7.410	23.665	2.463	2.617	2880.2	1995.9	884.3
17-2330	36.313	7.454	23.761	2.478	2.619	2885.5	2004.8	880.7
18-0030	36.471	7.499	23.862	2.484	2.626	2891.0	2007.9	883.1
18-0130	36.622	7.542	23.951	2.490	2.639	2895.2	2010.7	884.5

18.0230	36.789	7.587	24.058	2.495	2.447	2899.5	2013.5	886.8
18.0330	36.932	7.630	24.139	2.501	2.662	2905.5	2016.3	889.3
18.0430	-	-	-	-	-	2910.8	2019.8	891.8
18.0530	37.098	7.676	24.233	2.512	2.669	2915.6	2025.7	889.8
18.0630	37.246	7.721	24.298	2.517	2.711	2920.1	2028.5	891.6
18.0730	37.400	7.765	24.338	2.522	2.775	2924.5	2031.2	893.6
18.0830	37.557	7.809	24.396	2.550	2.883	2929.2	2047.4	881.8
18.0930	37.703	7.847	24.448	2.555	2.853	2932.7	2050.1	883.6
18.1030	-	-	-	-	-	2936.4	2054.8	881.6
18.1130	37.849	7.886	24.524	2.568	2.872	2941.2	2062.1	879.1
18.1230	37.987	7.925	24.578	2.572	2.912	2945.9	2064.4	881.5
18.1330	38.133	7.969	24.592	2.584	2.987	2949.6	2070.6	879.8
18.1430	38.278	8.013	24.660	2.588	3.027	2952.5	2075.5	880.8
18.1530	38.406	8.052	24.705	2.591	3.058	2955.9	2074.2	881.8
18.1630	38.535	8.090	24.754	2.599	3.092	2959.1	2077.9	881.2
18.1730	38.664	8.128	24.802	2.602	3.132	2962.8	2079.6	883.2
18.1830	38.792	8.168	24.878	2.605	3.150	2967.6	2081.4	886.1
18.1930	38.915	8.204	24.963	2.616	3.135	2973.1	2086.7	886.4
18.2030	39.026	8.232	25.079	2.620	3.095	2978.5	2088.5	890.4
18.2130	39.153	8.263	25.249	2.634	3.087	2984.2	2095.3	888.9
18.2230	39.272	8.291	25.334	2.638	3.009	2987.6	2097.1	890.5
18.2330	39.391	8.323	25.436	2.652	2.988	2991.8	2102.8	887.2
19.0030	39.512	8.357	25.538	2.656	2.960	2996.1	2105.8	890.2
19.0130	39.611	8.386	25.567	2.660	2.995	3001.9	2108.0	893.9
19.0230	39.731	8.429	25.671	2.664	2.977	3007.1	2110.1	897.1
19.0330	39.851	8.456	25.767	2.668	2.968	3011.4	2112.2	899.2
19.0430	39.968	8.493	25.852	2.672	2.951	3014.3	2114.3	899.9
19.0530	40.090	8.531	25.944	2.684	2.930	3016.4	2121.3	895.1
19.0630	40.209	8.573	26.036	2.688	2.913	3018.6	2123.3	895.4
19.0730	40.328	8.615	26.113	2.692	2.908	3021.9	2125.3	896.6
19.0830	40.448	8.657	26.191	2.695	2.904	3025.9	2127.2	898.6
19.0930	40.560	8.700	26.263	2.703	2.903	3034.1	2131.4	902.5
19.1030	-	-	-	-	-	3044.3	2133.5	918.8

APPENDIX G. TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 7 OF 11

	TOTAL SULPHUR					EQUIVALENT BURNT STONE		
	KILOMOLS					KILOGRAMS		
DAY.HOUR	IN	FLUE	REGEN	FINES	IN-OUT	FEED	REMOVED	IN-OUT
19.1130	40.687	8.723	26.335	2.787	2.922	3054.9	2135.5	919.4
19.1230	40.801	8.747	26.402	2.716	2.937	3069.9	2140.5	929.5
19.1330	40.919	8.769	26.474	2.719	2.956	3079.2	2142.5	936.7
SHUT DOWN AT 19.1330 FOR 2 HOURS								
19.1530	41.037	8.791	26.552	2.725	2.969	3094.5	2145.9	948.6
19.1630	41.157	8.811	26.626	2.731	2.988	3105.6	2149.3	956.3
19.1730	41.277	8.830	26.699	2.740	3.008	3121.1	2158.7	962.4
19.1830	41.395	8.848	26.770	2.754	3.023	3130.4	2162.1	968.2
19.1930	41.511	8.866	26.841	2.762	3.041	3140.5	2167.5	973.4
19.2030	41.630	8.883	26.912	2.769	3.066	3156.5	2171.0	985.5
19.2130	41.751	8.901	26.990	2.776	3.084	3164.2	2174.7	989.4
19.2230	41.870	8.918	27.067	2.821	3.064	3173.7	2185.2	988.4
STONE CHANGE								
19.2330	41.991	8.939	27.145	2.827	3.080	3186.6	2208.9	977.7
20.0030	42.112	8.953	27.219	2.833	3.107	3199.3	2212.7	986.5
20.0130	42.234	8.956	27.294	2.839	3.134	3210.3	2216.6	993.7
20.0230	42.354	8.979	27.369	2.844	3.162	3219.2	2220.5	998.6
20.0330	42.475	8.992	27.443	2.848	3.190	3227.5	2223.5	1004.0
20.0430	42.595	9.007	27.519	2.852	3.217	3234.0	2226.5	1007.5
20.0530	42.715	9.021	27.592	2.863	3.239	3237.5	2234.8	1002.8
20.0630	42.835	9.036	27.667	2.867	3.265	3244.0	2238.6	1005.4
20.0730	42.955	9.051	27.741	2.873	3.290	3250.2	2243.2	1007.0
20.0830	43.075	9.066	27.820	2.879	3.310	3256.6	2247.8	1008.8
STONE CHANGE								
20.0930	43.194	9.082	27.895	2.884	3.333	3261.9	2258.4	1003.5
20.1030	43.316	9.099	27.970	2.894	3.353	3266.9	2259.6	1007.4
20.1130	43.434	9.117	28.055	2.900	3.362	3271.4	2264.0	1007.5
20.1230	43.552	9.141	28.136	2.906	3.370	3275.6	2268.2	1007.5

20-1330	43-671	9-166	28-214	2-915	3-376	3279-9	2274-6	1005-3
20-1430	-	-	-	-	-	3290-4	2280-9	1009-5
20-1530	43-790	9-189	28-284	2-922	3-395	3300-7	2285-8	1014-9
20-1630	43-909	9-213	28-363	2-925	3-403	3309-2	2291-0	1018-2
20-1730	44-028	9-233	28-424	3-008	3-202	3317-3	2398-7	918-6
20-1830	44-146	9-258	28-489	3-247	3-160	3327-9	2506-7	821-2
20-1930	44-266	9-268	28-563	3-415	3-015	3334-5	2620-4	714-1
20-2030	44-385	9-289	28-634	3-513	2-948	3344-5	2694-0	650-5

SHUT DOWN AT 20-2030 FOR 35 HOURS

22-0830	44-480	9-320	28-663	3-618	2-879	3364-3	2745-4	618-9

SHUT DOWN AT 22-0830 FOR 2 HOURS

22-1030	44-595	9-347	28-719	3-656	2-873	3388-8	2766-6	622-2
22-1130	44-707	9-367	28-736	3-665	2-945	3401-8	2771-4	630-4
22-1230	44-831	9-389	28-798	3-673	2-971	3417-9	2776-2	641-7
22-1330	44-946	9-410	28-872	3-680	2-984	3440-3	2780-6	659-7
22-1430	45-062	9-429	28-945	3-684	3-004	3457-5	2783-3	674-2
22-1530	45-187	9-451	29-027	3-688	3-021	3469-3	2786-0	683-3
22-1630	45-298	9-469	29-111	3-692	3-025	3481-0	2788-7	692-3
22-1730	45-405	9-488	29-188	3-703	3-034	3492-6	2796-1	696-4
22-1830	45-526	9-509	29-257	3-707	3-054	3505-2	2798-5	706-7
22-1930	45-635	9-526	29-357	3-711	3-041	3516-1	2800-7	715-4
22-2030	45-743	9-543	29-443	3-715	3-043	3525-3	2802-8	722-5
22-2130	45-835	9-558	29-513	3-718	3-046	3533-7	2804-9	728-8
22-2230	45-928	9-573	29-578	3-722	3-055	3544-0	2807-0	737-0
22-2330	46-020	9-586	29-657	3-730	3-046	3553-3	2813-1	740-2
23-0030	46-111	9-600	29-713	3-734	3-063	3564-1	2815-4	748-7
23-0130	46-200	9-614	29-767	3-743	3-076	3574-1	2822-0	752-1

APPENDIX G. TABLE 9G.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 8 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLES IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
23-0230	46.288	9.629	29.840	3.752	3.068	3582.0	2828.7	753.3
23-0330	46.374	9.645	29.909	3.760	3.060	3591.3	2835.4	755.9
23-0430	46.461	9.662	29.982	3.764	3.053	3601.0	2837.5	763.5
23-0530	46.548	9.681	30.045	3.776	3.046	3609.0	2840.2	768.8
23-0630	46.635	9.700	30.103	3.785	3.047	3620.0	2854.8	765.2
23-0730	46.722	9.720	30.168	3.789	3.045	3628.3	2857.3	771.0
23-0830	46.809	9.738	30.253	3.794	3.024	3643.5	2860.0	783.5
23-0930	46.898	9.757	30.311	3.801	3.029	3660.6	2864.5	796.1
23-1030	46.995	9.778	30.318	3.809	3.090	3674.4	2869.0	805.4
23-1130	47.101	9.799	30.368	3.835	3.099	3685.5	2890.7	794.8
23-1230	47.210	9.822	30.435	3.841	3.112	3697.4	2894.2	803.2
23-1330	47.330	9.847	30.483	3.844	3.156	3706.6	2896.6	810.0
23-1430	47.442	9.875	30.552	3.848	3.167	3715.9	2899.1	816.8
23-1530	47.565	9.905	30.620	3.851	3.188	3725.9	2901.5	824.4
23-1630	47.686	9.932	30.726	3.855	3.173	3735.1	2904.0	831.1
23-1730	47.808	9.959	30.811	3.861	3.176	3744.1	2909.2	834.9
23-1830	47.929	9.990	30.890	3.864	3.185	3752.8	2911.1	841.7
23-1930	48.053	10.023	30.960	3.866	3.204	3761.5	2912.5	849.0
23-2030	48.171	10.056	31.047	3.980	3.088	3771.0	2994.8	776.2
23-2130	48.288	10.094	31.074	3.982	3.138	3779.7	2996.1	783.6
23-2230	48.408	10.136	31.081	3.984	3.207	3786.5	2997.5	789.0
23-2330	48.528	10.182	31.081	3.990	3.275	3794.7	3001.3	793.4
24-0030	48.643	10.224	31.081	3.992	3.346	3802.9	3002.8	800.1
24-0130	48.755	10.261	31.081	3.995	3.418	3808.7	3004.5	804.2
24-0230	48.858	10.297	31.090	3.998	3.473	3812.9	3006.3	806.6
24-0330	48.980	10.330	31.085	4.001	3.565	3817.8	3008.0	809.8
24-0430	49.085	10.360	31.098	4.004	3.623	3821.9	3009.7	812.2
24-0530	-	-	-	-	-	3825.6	3014.1	811.5

24-0630	49-177	10-386	31-124	4-006	3-661	3829-3	3815-7	613-6
24-0730	49-278	10-410	31-196	4-008	3-655	3832-2	3817-0	815-2
24-0830	49-363	10-438	31-291	4-015	3-618	3835-9	3821-1	814-2
24-0930	49-455	10-465	31-336	4-018	3-637	3845-4	3822-7	832-7
24-1030	49-553	10-490	31-440	4-021	3-602	3860-2	3824-2	835-9
24-1130	49-653	10-512	31-557	4-028	3-556	3875-5	3828-7	846-8
24-1230	49-753	10-531	31-671	4-032	3-519	3889-7	3831-4	858-3
24-1330	49-854	10-548	31-794	4-036	3-476	3902-7	3833-8	868-9
24-1430	49-954	10-565	31-913	4-040	3-435	3915-3	3836-1	879-2
24-1530	50-054	10-581	32-021	4-044	3-407	3928-0	3838-5	889-6
24-1630	50-154	10-598	32-129	4-048	3-379	3939-4	3840-8	898-5
24-1730	50-254	10-615	32-233	4-056	3-351	3950-2	3846-7	903-5
24-1830	50-354	10-631	32-337	4-061	3-325	3957-6	3849-4	908-1
24-1930	50-454	10-649	32-436	4-066	3-314	3965-7	3852-5	913-2
24-2030	-	-	-	-	-	3975-8	3854-8	921-0
24-2130	-	-	-	-	-	3984-7	3856-2	928-6
24-2230	50-556	10-666	32-487	4-068	3-334	3993-2	3857-6	935-6
24-2330	50-655	10-684	32-589	4-077	3-306	4003-7	3862-9	940-9
25-0030	50-755	10-700	32-684	4-079	3-291	4015-6	3864-2	951-4
25-0130	50-855	10-718	32-777	4-096	3-254	4025-1	3874-6	958-5
25-0230	50-956	10-735	32-864	4-104	3-252	4037-3	3879-3	957-9
25-0330	51-055	10-752	32-981	4-111	3-291	4047-6	3883-7	963-8
25-0430	51-159	10-770	33-082	4-114	3-272	4052-6	3885-5	967-1
25-0530	51-255	10-787	33-071	4-117	3-280	4055-2	3887-2	968-0
25-0630	51-358	10-806	33-159	4-124	3-278	4057-6	3891-3	966-3
25-0730	51-456	10-827	33-286	4-127	3-303	4060-2	3893-3	967-2
25-0830	51-355	10-847	33-287	4-161	3-340	4063-7	3116-8	947-6

SHUT DOWN AT 25-0830 FOR 6 HOURS

25-1430	51-648	10-866	32-261	4-214	3-306	4065-2	3160-3	985-0
25-1530	51-741	10-889	33-326	4-225	3-301	4071-8	3166-7	984-4

24-0630	49-177	10-386	31-124	4-006	3-661	3829-3	3015-7	813-6
24-0730	49-270	10-410	31-196	4-008	3-655	3830-2	3017-0	815-2
24-0830	49-363	10-438	31-291	4-015	3-618	3835-9	3021-1	814-8
24-0930	49-455	10-465	31-336	4-018	3-637	3845-4	3022-7	825-2
24-1030	49-553	10-490	31-440	4-021	3-602	3860-2	3024-2	835-0
24-1130	49-653	10-512	31-557	4-028	3-556	3875-5	3028-7	846-0
24-1230	49-753	10-531	31-671	4-032	3-519	3889-7	3031-4	858-3
24-1330	49-854	10-548	31-794	4-036	3-476	3902-7	3033-0	868-9
24-1430	49-954	10-565	31-913	4-040	3-435	3915-3	3036-1	879-2
24-1530	50-054	10-581	32-021	4-044	3-407	3928-8	3038-5	889-6
24-1630	50-154	10-598	32-129	4-048	3-379	3939-4	3040-0	898-5
24-1730	50-254	10-615	32-233	4-056	3-351	3950-2	3046-7	903-5
24-1830	50-354	10-631	32-337	4-061	3-325	3957-6	3049-4	908-1
24-1930	50-454	10-649	32-426	4-066	3-314	3965-7	3052-5	913-2
24-2030	-	-	-	-	-	3975-8	3054-0	921-0
24-2130	-	-	-	-	-	3984-7	3056-2	928-6
24-2230	50-556	10-666	32-487	4-068	3-334	3993-2	3057-6	935-6
24-2330	50-655	10-684	32-589	4-077	3-386	4003-7	3062-9	948-0
25-0030	50-755	10-700	32-684	4-079	3-291	4015-6	3064-2	951-4
25-0130	50-855	10-718	32-777	4-096	3-264	4025-1	3074-6	958-5
25-0230	50-956	10-735	32-864	4-104	3-252	4037-3	3079-3	957-9
25-0330	51-055	10-752	32-981	4-111	3-291	4047-6	3083-7	963-0
25-0430	51-159	10-770	33-002	4-114	3-272	4052-6	3085-5	967-1
25-0530	51-255	10-787	33-071	4-117	3-259	4055-2	3087-2	966-0
25-0630	51-358	10-806	33-159	4-124	3-270	4057-6	3091-3	966-3
25-0730	51-456	10-827	.3-388	4-127	3-303	4060-2	3093-0	967-2
25-0830	51-555	10-847	33-287	4-161	3-340	4063-7	3116-0	947-6

SHUT DOWN AT 25-0830 FOR 6 HOURS

25-1430	51-648	10-866	33-361	4-214	3-306	4065-2	3168-3	985-0
25-1530	51-741	10-889	33-386	4-225	3-301	4071-8	3166-7	984-4

APPENDIX G4 TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 9 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
SHUT DOWN AT 25-1530 FOR 7 HOURS								
25-2230	51.848	10.920	33.401	4.234	3.292	4073.7	3171.1	902.6
25-2330	51.955	10.949	33.465	4.240	3.301	4079.7	3174.9	904.8
26-0030	52.056	10.976	33.527	4.242	3.312	4085.3	3176.2	909.1
26-0130	52.169	11.004	33.559	4.244	3.362	4092.7	3177.4	915.3
26-0230	52.272	11.029	33.590	4.246	3.406	4099.5	3178.7	920.8
26-0330	52.381	11.055	33.622	4.249	3.455	4106.7	3179.9	926.8
26-0430	52.490	11.081	33.637	4.252	3.520	4112.7	3182.0	930.7
26-0530	52.593	11.106	33.714	4.255	3.518	4117.5	3183.2	934.3
26-0630	52.703	11.134	33.798	4.261	3.510	4125.1	3186.6	938.5
26-0730	52.806	11.160	33.872	4.267	3.507	4128.8	3186.0	942.8
26-0830	52.913	11.187	33.948	4.439	3.339	4135.2	3315.2	820.0
SHUT DOWN AT 26-0830 FOR 14 HOURS								
26-2230	53.017	11.213	34.008	4.444	3.352	4165.3	3318.5	846.8
26-2330	53.125	11.235	34.074	4.474	3.341	4194.5	3335.6	858.9
27-0030	53.232	11.252	34.084	4.487	3.409	4222.0	3342.4	879.6
27-0130	53.339	11.268	34.100	4.491	3.481	4235.5	3344.4	891.1
27-0230	53.446	11.285	34.302	4.494	3.365	4255.5	3346.4	909.1
27-0330	53.553	11.299	34.415	4.498	3.341	4268.7	3348.3	920.4
27-0430	53.659	11.312	34.527	4.502	3.318	4280.3	3350.3	930.0
27-0530	53.764	11.324	34.630	4.506	3.304	4294.3	3352.2	942.1
27-0630	53.867	11.336	34.738	4.509	3.284	4305.1	3354.2	950.9
27-0730	53.981	11.350	34.858	4.528	3.244	4309.9	3366.6	943.3
27-0830	54.087	11.367	34.857	4.533	3.330	4314.1	3368.9	945.2
27-0930	54.186	11.383	34.964	4.537	3.302	4318.6	3371.7	946.9
27-1030	54.296	11.401	35.079	4.542	3.274	4323.9	3374.4	949.5
27-1130	-	-	-	-	-	4329.9	3379.7	950.2
27-1230	54.402	11.422	35.193	4.547	3.240	4337.1	3382.5	954.6

27-1330	54-580	11-440	35-340	4-550	3-176	4341-3	3384-4	956-9
27-1430	54-614	11-461	35-447	4-553	3-153	4345-2	3386-3	958-8
27-1530	54-720	11-480	35-559	4-557	3-124	4351-6	3398-2	960-4
27-1630	54-826	11-495	35-665	4-568	3-105	4363-2	3399-1	973-1
27-1730	54-931	11-511	35-772	4-612	3-037	4368-7	3425-5	941-9
27-1830	55-037	11-526	35-878	4-615	3-017	4372-9	3428-7	944-7
27-1930	55-143	11-544	35-991	4-619	2-990	4376-9	3430-6	946-3
27-2030	55-248	11-562	36-103	4-622	2-962	4383-5	3429-5	951-8
27-2130	55-360	11-584	36-219	4-625	2-933	4391-7	3434-3	957-1
27-2230	55-466	11-603	36-323	4-628	2-912	4398-8	3435-1	961-8
27-2330	55-567	11-620	36-428	4-634	2-893	4403-3	3440-6	965-7
28-0030	55-674	11-640	36-522	4-638	2-874	4409-4	3440-8	966-5
28-0130	55-779	11-659	36-619	4-643	2-858	4416-7	3445-3	971-5
28-0230	55-884	11-676	36-711	4-647	2-850	4427-8	3447-8	979-3
28-0330	55-989	11-692	36-813	4-652	2-834	4435-5	3450-2	985-3
28-0430	56-095	11-705	36-901	4-656	2-835	4444-7	3452-7	992-8
28-0530	56-201	11-718	36-993	4-685	2-805	4455-3	3470-9	988-4
28-0630	56-311	11-733	37-102	4-693	2-784	4462-1	3478-8	984-2
28-0730	56-415	11-746	37-202	4-701	2-764	4469-8	3484-8	985-8
28-0830	56-515	11-763	37-299	4-709	2-744	4480-1	3485-7	998-4
28-0930	56-622	11-778	37-398	4-710	2-736	4488-8	3490-8	998-8
28-1030	56-728	11-793	37-502	4-717	2-716	4496-2	3496-3	999-9
28-1130	56-833	11-808	37-605	4-723	2-697	4503-8	3501-8	1002-1
28-1230	56-939	11-822	37-708	4-725	2-684	4511-2	3502-9	1008-4
28-1330	57-048	11-837	37-812	4-734	2-665	4519-1	3510-1	1009-8
28-1430	57-157	11-854	37-909	4-738	2-656	4525-7	3512-6	1013-1
28-1530	57-277	11-874	37-995	4-753	2-655	4536-3	3526-4	1009-9
28-1630	-	-	-	-	-	4543-4	3528-4	1013-1
28-1730	57-397	11-887	38-095	4-759	2-656	4550-8	3534-3	1015-7
28-1830	57-517	11-900	38-195	4-768	2-645	4554-2	3540-8	1013-3

APPENDIX G. TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE.   PAGE 10 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
28-1930	57.638	11.913	38.314	4.785	2.626	4554.2	3548.9	1005.4
28-2030	57.758	11.926	38.416	4.829	2.587	4554.2	3583.4	970.8
28-2130	57.879	11.938	38.518	4.843	2.580	4554.2	3589.9	964.3
28-2230	57.997	11.953	38.563	4.906	2.574	4556.9	3660.5	896.4
SHUT DOWN AT 28-2230 FOR 34 HOURS								
29-2330	-	-	-	-	-	4556.9	3666.2	890.7
30-0030	58.130	12.009	38.630	4.921	2.570	4568.2	3673.3	894.9
30-0130	58.262	12.055	38.709	4.936	2.562	4578.0	3681.2	896.8
SHUT DOWN AT 30-0130 FOR 3 HOURS								
30-0430	58.403	12.122	38.763	4.952	2.565	4583.0	3689.8	893.2
30-0530	58.540	12.185	38.826	4.971	2.558	4593.9	3699.5	894.4
30-0630	58.661	12.225	38.894	4.980	2.562	4607.3	3704.0	903.3
30-0730	58.778	12.254	38.959	4.985	2.581	4627.1	3706.3	920.8
30-0830	58.889	12.272	39.027	4.994	2.596	4641.3	3710.0	931.3
30-0930	-	-	-	-	-	4654.0	3724.4	929.6
30-1030	58.994	12.285	39.084	5.002	2.624	4659.3	3727.9	931.4
30-1130	59.106	12.300	39.151	5.025	2.627	4664.6	3748.1	916.5
30-1230	59.212	12.316	39.218	5.041	2.637	4671.1	3757.0	914.2
30-1330	59.320	12.333	39.290	5.062	2.636	4678.1	3769.6	908.5
30-1430	59.427	12.351	39.364	5.071	2.641	4683.6	3773.3	910.2
30-1530	59.534	12.371	39.434	5.075	2.655	4687.8	3775.5	912.3
30-1630	59.644	12.392	39.508	5.079	2.665	4692.0	3777.6	914.4
30-1730	59.751	12.413	39.582	5.083	2.674	4696.5	3779.7	916.8
30-1830	59.860	12.437	39.662	5.087	2.674	4699.9	3781.8	918.1
30-1930	59.965	12.463	39.736	5.091	2.676	4703.9	3783.9	919.9
30-2030	60.072	12.490	39.808	5.095	2.679	4707.3	3786.1	921.2
30-2130	60.179	12.520	39.880	5.099	2.680	4708.4	3788.2	920.2
30-2230	60.299	12.570	39.956	5.103	2.670	4708.9	3790.3	918.6

30-2330	60-419	12-614	40-033	5-112	2-661	4709-9	3795-0	915-0
31-0030	60-552	12-642	40-100	5-116	2-665	4718-1	3797-3	914-8
31-0130	58-684	12-704	40-175	5-121	2-684	4723-7	3799-7	923-9
31-0230	60-817	12-734	40-253	5-127	2-702	4731-6	3800-2	929-4
31-0330	60-953	12-769	40-340	5-132	2-712	4737-9	3804-7	933-2
31-0430	61-091	12-805	40-409	5-138	2-731	4740-3	3807-2	934-2
31-0530	61-213	12-838	40-507	5-147	2-721	4744-0	3813-2	931-8
31-0630	61-325	12-867	40-572	5-154	2-736	4753-2	3815-1	937-2
31-0730	61-443	12-889	40-645	5-161	2-748	4763-8	3818-3	945-5
31-0830	61-554	12-912	40-727	5-169	2-746	4767-8	3823-6	946-2
31-0930	61-671	12-936	40-816	5-178	2-747	4775-4	3830-2	945-2
31-1030	61-776	12-958	40-883	5-182	2-754	4782-5	3832-4	950-1
31-1130	61-885	12-981	40-967	5-186	2-752	4789-6	3834-6	955-0
31-1230	61-996	13-009	41-050	5-190	2-747	4791-8	3836-8	954-1
31-1330	62-109	13-043	41-122	5-194	2-751	4791-0	3839-1	951-9
31-1430	62-217	13-077	41-121	5-197	2-821	4791-0	3841-3	949-7
31-1530	62-331	13-113	41-129	5-240	2-856	4791-8	3878-5	913-3
31-1630	62-449	13-152	41-129	5-243	2-934	4838-4	3880-7	947-7
31-1730	62-568	13-178	41-182	5-247	2-961	4853-8	3883-8	978-0
31-1830	62-692	13-209	41-235	5-253	2-991	4872-5	3887-7	984-8
31-1930	62-813	13-230	41-286	5-259	3-030	4894-7	3891-7	1003-0
			STONE CHANGE					
31-2030	62-927	13-249	41-334	5-264	3-080	4923-5	3895-5	1030-0
31-2130	63-049	13-268	41-396	5-270	3-116	4942-6	3895-5	1043-1
31-2230	63-178	13-287	41-460	5-275	3-140	4953-4	3903-6	1049-6
31-2330	63-292	13-306	41-522	5-299	3-155	4965-8	3921-2	1043-6
32-0030	63-414	13-325	41-602	5-304	3-173	4970-7	3924-7	1045-9
32-0130	63-532	13-344	41-680	5-308	3-192	4973-6	3927-6	1046-0
32-0230	63-651	13-361	41-760	5-312	3-216	4988-6	3930-5	1050-1
32-0330	63-772	13-380	41-828	5-315	3-240	4997-1	3933-4	1063-6

APPENDIX C; TABLE VI.

RUN 9: SULPHUR AND STONE CUMULATIVE BALANCE. PAGE 11 OF 11

DAY-HOUR	TOTAL SULPHUR KILOMOLS IN	FLUE	REGEN	FINES	IN-OUT	EQUIVALENT BURNT STONE KILOGRAMS FEED	REMOVED	IN-OUT
32-0430	63-891	13-398	41-900	5-319	3-274	5000-0	3936-3	1063-7
32-0530	64-011	13-416	41-960	5-326	3-309	5012-1	3941-0	1071-1
32-0630	64-130	13-434	42-018	5-326	3-352	5018-1	3941-0	1077-1
32-0730	64-241	13-452	42-068	5-326	3-395	5024-0	3941-0	1083-0
32-0830	64-347	13-469	42-095	5-540	3-244	5029-2	4056-3	972-9

Stone recovered during dismantling and inspection = 275 kilograms

Stone not recovered = 596 kilograms

Stone feed loss = 12%

APPENDIX G. - TABLE VII

ANALYSIS OF SOLIDS REMOVED DURING RUN 9

TOTAL SULPHUR WT.%

DAY.HOUR	GAS'R	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
3.1800	4.82	3.89	-	-	-	-	5.70
4.0830	5.59	4.05	-	-	-	-	6.21
5.0001	5.30	4.22	-	-	3.77	3.82	5.18
5.0800	4.45	3.39	-	-	-	-	4.98
5.1400	4.38	4.27	-	6.18	3.76	2.67	5.00
6.0000	4.48	3.38	-	5.36	3.07	3.50	5.09
6.0800	3.98	3.05	-	-	-	-	3.75
6.1200	3.16	2.67	-	-	-	-	3.80
6.2100	5.01	3.80	-	-	-	-	-
7.0000	5.27	3.92	-	-	-	-	5.75
7.1200	5.57	4.26	-	-	-	-	4.72
7.1800	5.23	3.73	-	-	-	-	4.81
8.0000	4.01	3.79	-	-	3.60	2.48	4.14
8.0800	4.32	3.80	-	-	-	-	3.92
8.1200	4.27	3.53	-	-	-	-	3.80
8.1800	4.59	3.83	-	-	-	-	4.14
8.2200	4.46	3.80	-	-	-	-	4.48
9.1200	4.61	3.71	-	-	-	-	4.35
9.1800	4.38	2.80	-	-	-	-	4.83
10.0000	4.36	3.32	4.37	3.73	4.12	3.25	4.00
10.1200	4.36	3.16	-	-	-	-	4.04
10.1800	4.17	2.81	-	-	-	-	3.79
11.0000	3.84	2.80	3.98	3.08	3.92	2.15	3.56
11.0350	3.85	2.51	-	-	-	-	-
11.1200	4.58	3.74	-	-	-	-	4.59
11.1800	4.38	3.50	-	-	-	-	4.10
12.0000	6.38	3.81	3.98	4.27	4.28	3.17	4.14
12.0800	4.36	3.65	-	-	-	-	3.92
12.1200	4.32	2.49	4.04	4.15	4.15	3.38	4.07
12.1800	3.65	2.53	3.96	3.93	-	-	-
13.0000	3.78	2.67	3.18	3.87	4.38	4.21	3.43
13.0800	3.71	2.71	-	-	-	-	4.12
13.1200	5.84	3.82	4.34	3.89	4.37	3.48	4.82
14.0000	4.99	3.61	-	-	-	-	4.67
14.1100	6.25	-	-	-	-	-	-
14.1200	6.52	6.64	5.85	5.13	5.00	4.39	6.38
14.1800	5.18	3.99	5.42	5.59	-	-	-
15.0000	4.66	3.94	4.76	6.18	6.11	3.82	4.59
15.0700	4.08	3.00	-	-	-	-	4.66
15.1200	4.39	3.82	5.54	4.84	5.66	3.61	-

APPENDIX 3.___ - TABLE VII

ANALYSIS OF SOLIDS REMOVED DURING RUN V
TOTAL SULPHUR WT.%

DAY.HOUR	GAS'R	SPENT	SPENT CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
16.1800	4.98	4.88	5.77	3.98	4.03	3.36	-
17.0000	4.81	3.86	5.97	3.71	4.29	3.25	4.28
17.0800	3.13	4.40	5.57	3.38	3.75	4.87	3.86
17.1245	4.66	3.24	-	-	-	-	-
17.1545	5.12	3.93	-	-	-	-	-
17.1700	-	-	5.24	3.46	4.49	4.83	4.37
18.0000	5.16	3.53	5.30	3.77	8.37	4.84	4.05
18.0800	5.16	3.68	-	-	-	-	4.41
18.1200	4.78	6.22	5.70	3.57	-	-	6.51
18.1600	7.05	7.08	-	-	-	-	6.79
19.0000	7.24	6.81	5.41	4.81	5.39	5.65	6.53
19.0800	6.32	4.49	6.08	-	-	-	6.79
19.1200	4.77	3.69	7.22	-	-	-	5.35
19.1600	3.86	4.52	5.30	-	-	-	5.33
20.0000	4.30	3.27	5.65	4.89	5.42	3.63	4.31
20.0800	4.69	3.61	4.70	2.82	-	-	-
20.1600	4.28	3.68	-	-	-	-	-
20.1800	4.88	3.67	3.31	5.98	-	-	-
22.1600	6.30	2.85	-	-	-	-	5.17
23.0015	3.83	2.72	-	5.31	-	2.78	3.51
23.0800	3.92	2.26	7.81	-	4.82	-	3.48
23.1200	3.74	2.30	-	-	-	-	3.30
23.1600	3.34	1.50	-	-	-	-	3.70
24.0000	4.23	3.99	9.78	3.78	3.86	4.11	4.88
24.0800	6.77	5.08	-	-	-	-	6.21
24.0900	6.96	1.04	-	-	-	-	7.88
24.1200	5.30	4.67	9.26	4.74	4.97	4.51	7.02
24.1600	3.43	2.89	7.88	-	-	-	3.66
25.0000	2.88	1.43	5.99	5.55	5.22	3.86	4.04
25.0800	2.73	1.82	6.15	-	-	-	3.98
26.0000	4.50	3.21	5.75	5.46	4.82	5.12	5.14
26.0800	6.83	2.25	7.45	-	-	-	6.98
27.0000	3.24	2.24	7.53	-	-	-	4.04
27.1230	3.41	2.29	6.24	3.70	4.71	4.71	4.15
27.1630	2.32	2.05	-	-	-	-	4.30
28.0000	2.56	2.27	6.93	4.85	3.75	4.79	5.25
28.0800	2.78	2.18	-	-	-	-	4.32
28.1230	2.89	6.30	5.55	3.39	4.89	4.42	3.22
28.1645	3.13	2.22	4.37	3.22	-	-	2.86
30.0000	3.48	2.61	-	6.08	-	-	8.23

APPENDIX II, TABLE VII

ANALYSIS OF SOLIDS REMOVED DURING RUN 9
TOTAL SULPHUR WT.%

DAY.HOUR	GAS'R	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
30.1200	3.90	2.00	0.00	-	-	-	5.33
30.1600	6.27	2.93	7.59	-	-	-	4.18
31.0400	11.17	3.30	6.90	4.12	0.03	5.31	3.79
31.0800	4.18	3.15	8.79	-	-	-	6.76
31.1200	4.28	3.40	8.73	-	-	-	7.08
31.1600	6.09	3.42	9.35	-	-	-	3.80
32.0000	5.80	4.24	8.47	4.72	2.84	2.37	5.00
32.0400	5.77	4.78	5.14	-	-	-	4.46
32.0400	5.71	4.78	5.14	4.72	2.84	2.37	4.46

APPENDIX G. TABLE VIII

ANALYSIS OF SOLIDS REMOVED DURING RUN 9

	SULFATE SULFUR WT.%						
DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BANK	BOILER FLUE	ELUTR COARSE
2.1800	0.03	0.52	-	-	-	-	0.22
4.0030	-	0.26	-	-	-	-	1.06
5.0001	0.22	0.81	-	-	0.03	1.40	0.09
5.0800	0.06	0.08	-	-	-	-	0.11
5.1400	0.06	0.70	-	0.34	0.10	1.91	0.16
6.0000	0.06	1.11	-	0.35	0.91	2.84	0.15
6.0800	0.10	1.09	-	-	-	-	0.14
6.1200	0.01	1.03	-	-	-	-	0.09
6.2100	0.01	-	-	-	-	-	-
7.0000	0.08	0.88	-	-	-	-	0.03
7.1200	0.07	0.31	-	-	-	-	0.23
7.1600	0.08	0.58	-	-	-	-	0.09
8.0000	0.05	0.60	-	-	1.90	1.09	0.09
8.0800	0.06	0.06	-	-	-	-	0.18
8.1200	0.06	0.72	-	-	-	-	0.13
8.1600	0.06	0.15	-	-	-	-	0.11
8.2000	0.06	0.46	-	-	-	-	-
9.1200	0.04	0.61	-	-	-	-	0.12
9.1600	0.05	0.67	-	-	-	-	0.16
10.0000	0.07	0.59	1.21	0.27	1.57	2.33	0.12
10.1200	0.06	0.77	-	-	-	-	0.10
10.1600	0.04	0.43	-	-	-	-	0.10
11.0000	0.05	0.58	1.50	0.26	1.31	2.00	0.09
11.0400	0.01	0.53	-	-	-	-	-
11.1200	0.03	0.37	-	-	-	-	0.20
11.1600	-	-	-	-	-	-	2.40
12.0000	0.02	0.05	1.51	1.80	1.44	2.70	0.12
12.0400	0.03	0.07	-	-	-	-	0.07
12.1200	0.03	0.70	1.64	0.30	1.44	2.26	0.11
12.1600	0.08	0.52	1.61	0.37	-	-	-
13.0000	0.09	0.41	1.18	0.29	1.17	2.20	0.14
13.0400	0.07	0.53	-	-	-	-	0.09
13.1200	0.04	0.21	0.44	0.14	1.31	2.07	0.09
14.0400	0.06	0.10	-	-	-	-	0.23
14.1100	0.02	-	-	-	-	-	-
14.1200	0.04	0.04	1.01	0.24	3.00	2.37	0.15
14.1600	0.07	0.52	1.84	0.46	-	-	-
15.0030	0.09	0.46	3.74	1.06	2.03	2.67	0.20
15.0700	0.18	1.12	-	-	-	-	0.24
15.1200	0.09	1.08	4.30	0.85	2.34	2.36	-

APPENDIX C. TABLE VIII

ANALYSIS OF SOLIDS REMOVED DURING RUN 9
SULPHATE SULPHUR, WT.%

DAY.HOUR	GAS'R	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
16.1600	0.10	0.80	3.51	0.41	1.24	2.43	-
17.0000	0.11	0.97	4.90	0.31	2.05	2.24	0.11
17.0800	0.12	0.77	4.20	0.30	1.40	3.26	0.11
17.1245	0.09	0.73	-	-	-	-	-
17.1645	0.10	0.76	-	-	-	-	-
17.1700	-	-	3.14	0.24	1.98	3.29	0.11
18.0000	0.08	0.44	3.06	0.34	2.88	3.28	0.07
18.0800	0.07	0.16	-	-	-	-	0.11
18.1200	0.02	0.24	2.26	0.20	-	-	0.07
18.1600	0.20	0.01	-	-	-	-	0.05
19.0000	0.07	0.	1.20	0.36	0.07	2.74	0.10
19.0800	0.10	0.50	2.53	-	-	-	0.10
19.1200	0.08	0.88	4.08	-	-	-	0.20
19.1600	0.07	0.02	4.21	-	-	-	0.08
20.0000	0.10	0.25	2.70	0.22	1.07	2.04	0.11
20.0800	0.08	0.44	1.82	0.	-	-	-
20.1000	0.08	0.70	-	-	-	-	-
22.1000	0.15	0.89	0.17	4.17	-	-	-
22.1600	0.08	1.12	-	-	-	-	0.
23.0015	0.	1.04	-	0.	-	2.21	0.07
23.0800	0.03	1.33	6.33	-	1.37	-	0.06
23.1200	0.08	1.73	-	-	-	-	0.07
23.1600	0.06	0.77	-	-	-	-	0.04
24.0000	0.05	0.	6.70	0.20	1.72	3.02	0.04
24.0400	0.05	0.05	-	-	-	-	0.
24.0800	0.	0.74	-	-	-	-	0.
24.1200	0.	0.23	2.24	0.07	3.14	2.71	0.08
24.1600	0.02	0.03	3.50	-	-	-	0.
25.0000	0.	0.80	4.13	1.23	2.46	2.76	1.26
25.0800	0.03	0.45	4.70	-	-	-	0.
26.0000	0.	0.05	2.26	0.61	2.77	3.00	0.06
26.0800	0.02	1.16	4.77	-	-	-	0.04
27.0000	0.	1.26	2.10	-	-	-	0.
27.1230	0.10	0.61	2.74	0.34	2.03	3.37	0.10
27.1630	0.02	0.54	-	-	-	-	0.07
28.0000	0.03	0.59	1.95	0.36	2.56	3.37	0.03
28.0800	0.05	0.03	-	-	-	-	0.05
28.1230	0.01	0.51	2.16	0.31	1.95	3.01	0.04
28.1645	0.04	0.38	2.16	0.80	-	-	0.03
30.0000	0.04	0.76	-	0.27	-	-	0.10

APPENDIX C. TABLE VIII

ANALYSIS OF SOLIDS REMOVED DURING RUN 5

	SULPHATE	SULPHUR,	WT.%				
DAY.HOUR	GASIF	REGEN	REGEN CYCLONE	SLUTH FINES	BOILER BACK	BOILER FLUE	SLUTH COALSF
20.1200	0.05	0.75	2.67	-	-	-	0.04
20.1600	0.04	0.70	2.40	-	-	-	0.06
21.0000	0.04	0.47	3.43	0.12	3.42	4.61	0.18
21.0400	0.07	0.45	3.33	-	-	-	0.15
21.1200	0.06	0.52	3.73	-	-	-	0.13
21.1600	0.06	1.02	4.05	-	-	-	0.09
22.0000	0.02	0.25	6.04	0.40	1.04	2.23	0.13
22.0800	0.05	0.76	3.72	-	-	-	0.46
23.0000	0.06	0.76	3.73	0.40	1.64	2.23	0.40

APPENDIX G. TABLE IX.

ANALYSIS OF SOLIDS REMOVED DURING RUN 9
TOTAL CARBON, WT%

DAY.HOUR	GASF'R	REGEN	REGEN. CYCLONE	FLUID FINES	BOILER BAGS	BOILER FLUE	FLUID COARSE
2.1800	0.29	0.	-	-	-	-	0.19
4.0030	0.34	0.02	-	-	-	-	1.20
4.2001	0.	0.	-	-	0.14	0.25	0.02
5.0000	0.	0.	-	-	-	-	0.36
5.1400	0.	0.	-	1.03	0.	0.	0.31
6.0000	0.	0.	-	0.43	0.	0.	0.
6.0000	0.	0.	-	-	-	-	0.03
6.1200	0.	0.	-	-	-	-	0.24
6.2100	0.88	0.07	-	-	-	-	-
7.0000	0.80	0.	-	-	-	-	1.75
7.1200	0.19	0.	-	-	-	-	2.31
7.1800	0.37	0.	-	-	-	-	0.00
8.0000	0.	0.	-	-	0.	0.08	0.
8.0600	0.	0.	-	-	-	-	0.
8.1200	0.	0.	-	-	-	-	0.
8.1800	0.71	0.	-	-	-	-	0.56
8.2200	0.49	0.	-	-	-	-	0.03
9.1200	0.06	0.	-	-	-	-	0.34
9.1800	0.	0.	-	-	-	-	0.
10.0000	0.12	0.	2.30	7.07	0.16	2.02	0.19
10.1200	0.06	0.	-	-	-	-	0.15
10.1800	0.37	0.	-	-	-	-	0.18
11.0000	0.42	0.	0.56	3.53	0.14	2.02	0.26
11.0350	0.14	0.	-	-	-	-	-
11.1200	0.14	0.	-	-	-	-	0.19
11.1800	0.24	0.	-	-	-	-	0.31
12.0000	0.	0.	0.30	2.77	0.13	3.33	0.06
12.0600	0.08	0.	-	-	-	-	0.74
12.1200	0.06	0.	-	10.90	-	-	0.24
12.1800	0.14	0.03	-	0.70	-	-	-
13.0000	0.35	0.	10.40	-	-	-	0.41
13.0600	0.20	0.	-	-	-	-	0.05
13.1200	0.57	0.	0.36	15.59	0.07	12.08	1.13
14.0000	1.07	0.	-	-	-	-	1.00
14.1100	1.81	-	-	-	-	-	-
14.1200	1.30	0.45	0.97	3.05	0.21	7.40	1.56
14.1800	0.	0.	1.63	9.00	-	-	-
15.0000	0.16	0.05	0.02	3.07	0.37	0.31	0.52
15.0700	0.22	0.	-	-	-	-	0.25
15.1200	0.13	0.	1.07	3.76	0.74	5.54	-

APPENDIX G. TABLE IX.

ANALYSIS OF SOLIDS REMOVED DURING RUN 4
TOTAL CARBON WT%

DAY.HOUR	GASIF'R	REGEN	REGEN. CYCLONE	ELUTR FINES	BOILER RACK	BOILER FLUE	ELUTR COARSE
16.1500	0.	0.50	1.42	0.57	0.50	0.13	-
17.0000	0.	0.	0.05	17.24	0.04	10.57	0.15
17.0800	0.	0.	0.01	10.23	0.28	4.28	0.10
17.1245	0.13	0.	-	-	-	-	-
17.1545	0.22	0.	-	-	-	-	-
17.1700	-	-	0.74	11.05	0.13	0.50	0.27
18.0000	0.13	0.	0.77	12.09	0.	3.82	2.30
18.0800	0.40	0.	-	-	-	-	0.42
18.1200	0.21	0.	1.73	20.54	-	-	0.53
18.1600	0.	0.04	-	-	-	-	0.98
19.0000	0.18	0.	2.02	24.09	0.88	14.29	0.08
19.0800	0.	0.	3.97	-	-	-	0.30
19.1200	0.	0.	3.29	-	-	-	3.27
19.1600	0.	0.	0.42	-	-	-	1.04
20.0000	0.05	0.	0.48	11.09	0.09	4.67	0.46
20.0800	0.02	2.03	0.	0.	-	-	-
20.1200	0.09	0.	-	-	-	-	-
20.1600	0.	0.	13.95	0.89	-	-	-
22.1600	0.20	0.	-	-	-	-	1.35
23.0015	0.	0.	-	9.29	-	5.84	0.08
23.0800	0.	0.	2.18	-	0.25	-	0.
23.1200	0.	0.	-	-	-	-	0.49
23.1600	0.22	0.	-	-	-	-	1.08
24.0000	4.27	0.32	2.07	22.49	0.02	11.81	7.77
24.0800	1.47	0.45	-	-	-	-	3.25
24.0900	0.32	0.	-	-	-	-	1.42
24.1200	0.22	0.	2.24	3.77	0.18	5.09	1.78
24.1600	0.	0.	1.72	-	-	-	0.
25.0000	0.	0.	1.69	0.03	0.19	2.37	0.
25.0800	0.13	0.	0.19	-	-	-	0.41
26.0000	0.	0.48	2.98	3.37	0.	5.83	2.24
26.0800	0.71	0.	2.19	-	-	-	0.
27.0800	0.	0.	0.28	-	-	-	1.47
27.1230	0.	0.	1.83	14.75	0.28	7.18	1.22
27.1830	0.	0.	-	-	-	-	4.79
28.0000	0.	0.	2.14	5.69	0.17	0.47	5.79
28.0800	0.	0.	-	-	-	-	2.22
28.1230	0.	0.	4.11	14.36	0.28	0.05	1.16
28.1645	0.	0.	0.26	13.15	-	-	3.09
29.0000	0.	0.	-	0.35	-	-	0.19

APPENDIX G TABLE IX

ANALYSIS OF SOLIDS REMOVED DURING RUN 9

				WTS			
DAY.HOUR	RAD'S	REGEN	REGEN CYCLONE	FLUID FINES	BOILER BACK	BOILER FLUE	FLUID COARSE
30.1200	0.	0.	0.55	-	-	-	0.
30.1600	0.	0.	2.07	-	-	-	10.80
31.0000	0.	0.	3.15	4.14	0.16	4.21	1.28
31.0400	0.16	0.	0.90	-	-	-	13.02
31.1200	0.	0.	0.54	-	-	-	3.93
31.1600	0.	0.04	0.23	-	-	-	0.67
32.0000	0.	0.	0.	0.84	0.12	0.64	2.26
32.0400	0.	0.	0.36	-	-	-	0.71
32.0800	0.	0.	0.36	0.84	0.12	0.64	0.71

APPENDIX 8. - TABLE X

SOLIDS REMOVED DURING RUN 9, KG. (RAW DATA)

DAY.HOUR	GAS'N	REGEN	REGEN. CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR CHARGE
0.1730	-	-	-	-	-	9.38	-
2.0800	-	-	-	0.08	0.11	4.99	-
2.1000	0.01	0.01	-	0.01	-	14.06	-
3.0800	-	-	-	32.21	-	9.44	-
4.0030	-	-	-	-	4.76	-	-
4.1525	-	-	-	1.59	-	-	-
4.1600	-	-	-	1.36	-	-	-
4.1820	-	-	-	1.59	2.49	23.59	-
4.1955	-	-	-	1.59	-	-	-
4.2025	-	-	-	4.00	-	-	-
4.2315	0.01	0.01	-	0.01	2.49	14.06	-
5.0220	-	-	-	-	-	-	17.02
5.0800	0.01	0.01	-	0.01	-	-	-
5.1100	-	-	-	2.27	12.25	22.08	4.21
5.1205	-	-	-	-	-	-	7.71
5.1230	-	-	-	-	-	-	6.12
5.1400	-	-	-	13.61	9.53	7.26	2.06
5.1720	-	-	-	20.41	-	-	-
5.1845	-	-	-	0.98	4.54	6.80	2.05
5.2045	-	-	-	0.44	-	-	-
5.2350	0.01	0.01	-	32.66	3.63	9.07	0.01
6.0045	-	-	-	5.22	-	-	-
6.0145	-	-	-	5.00	-	-	-
6.0245	-	-	-	-	-	6.80	-
6.0300	-	-	-	0.10	-	-	-
6.0420	-	-	-	0.00	-	-	-
6.0515	-	-	-	2.49	-	-	-
6.0615	0.01	0.01	-	0.05	-	0.16	0.01
6.0715	-	-	-	10.66	-	-	-
6.0730	-	-	-	-	-	3.18	-
6.0815	-	-	-	5.07	-	-	-
6.0915	-	-	-	4.70	-	-	-
6.1100	-	-	-	3.40	-	12.70	15.20
6.1200	-	-	-	5.44	39.46	-	-
6.1430	-	-	-	5.44	27.57	14.06	-
6.1600	-	-	-	12.70	9.53	-	-
6.1900	-	-	-	2.72	-	-	-
6.2030	-	-	-	-	11.11	5.44	21.77
6.2035	-	-	-	-	-	1.01	20.87
7.0230	-	-	-	-	-	-	12.03

APPENDIX G TABLE 5

SOLIDS REMOVED HERE JAN 9 KG. (RAW DATA)

DAY.HOUR	BAG'H	BROWN	UPPER CYCLONE	FLUTH FINES	BOILER BACK	BOILER FLUE	FLUTH COARSE
7.0700	-	-	-	3.63	-	-	-
7.0730	-	-	-	-	30.87	12.25	6.35
7.0830	-	-	-	-	-	-	4.54
7.0930	-	-	-	-	3.18	4.54	3.18
7.1000	-	-	-	-	1.36	-	1.81
7.1100	-	-	-	-	1.81	-	25.85
7.1530	-	-	-	-	9.30	-	3.18
7.1630	-	-	-	-	6.12	-	-
7.1900	-	-	-	-	4.54	8.16	0.91
7.2130	-	-	-	-	-	-	4.54
7.2230	-	-	-	-	-	-	4.54
8.0000	1.36	1.36	-	51.26	6.80	9.98	6.80
8.0030	-	-	-	0.91	-	-	9.44
8.0130	-	-	-	-	-	-	4.54
8.0230	-	-	-	-	-	-	4.54
8.0315	-	-	-	-	-	-	4.54
8.0430	-	-	-	-	-	-	4.54
8.0530	-	-	-	-	-	-	4.54
8.0630	1.36	1.95	-	-	-	-	4.54
8.0730	-	-	-	-	-	-	4.54
8.0830	-	-	-	-	-	-	4.54
8.1000	-	-	-	-	10.21	19.05	7.26
8.1130	-	-	-	0.91	-	-	9.98
8.1230	2.72	2.72	-	0.91	-	4.54	10.43
8.1330	-	-	1.13	1.81	-	2.95	4.99
8.1400	-	-	-	0.91	-	-	6.80
8.1600	-	-	1.59	2.95	-	2.72	6.80
8.1700	-	-	1.13	-	-	-	6.80
8.1800	2.72	2.72	0.68	3.18	12.70	4.54	6.80
8.1900	-	-	-	-	-	-	6.80
8.2000	-	-	1.13	1.13	-	2.95	6.80
8.2100	-	-	-	-	-	-	6.80
8.2200	2.72	2.72	-	-	-	-	6.80
9.1000	-	-	-	-	-	12.25	6.80
9.1130	-	-	-	35.38	-	-	-
9.1230	2.27	2.72	-	-	-	7.71	6.80
9.1330	-	-	4.54	0.91	-	-	3.40
9.1430	-	-	-	1.36	-	-	2.72
9.1630	-	-	-	0.23	-	-	6.80
9.1730	-	-	2.27	-	-	-	-

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APPENDIX G TABLE X

SOLIDS REMOVED DURING RUN 9, KG. (RAW DATA)

DAY.HOUR	GASIF	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
9.1800	2.27	2.72	-	-	9.98	11.34	0.91
9.1930	-	-	-	1.59	-	-	6.35
9.2030	-	-	1.36	-	-	-	1.81
10.0300	-	-	-	1.59	16.78	8.16	-
10.0615	-	-	1.36	1.13	9.53	5.90	5.44
10.0755	-	-	-	-	-	-	4.54
10.0900	-	-	-	4.54	-	-	8.16
10.1200	2.27	2.72	2.04	2.95	11.34	9.53	4.54
10.1400	-	-	-	1.81	-	-	4.54
10.1515	-	-	-	-	-	-	6.35
10.1700	-	-	-	2.49	6.80	5.90	4.54
10.1800	2.27	2.72	-	-	-	-	6.80
10.1945	-	-	-	2.95	-	-	3.63
10.2150	-	-	-	-	-	-	4.54
10.2245	-	-	5.44	-	-	-	-
10.2255	-	-	-	-	-	-	3.63
10.2350	2.27	2.72	1.36	3.18	11.34	8.16	6.80
11.0110	-	-	-	-	-	-	9.07
11.0200	-	-	1.36	1.36	-	-	9.07
11.0310	-	-	-	1.13	-	-	9.07
11.0350	2.27	2.72	0.91	0.45	-	-	-
11.0410	-	-	-	-	-	-	9.07
11.0600	-	-	0.91	1.36	9.98	7.71	-
11.0800	-	-	1.13	2.04	-	-	9.07
11.0900	-	-	-	-	-	-	9.07
11.1000	-	-	0.68	1.81	-	-	9.07
11.1100	-	-	-	-	-	-	9.07
11.1200	2.27	2.72	-	1.81	-	-	9.07
11.1230	-	-	-	-	-	-	2.72
11.1300	-	-	-	-	3.63	8.16	-
11.1430	-	-	1.13	2.27	-	-	-
11.1730	-	-	-	-	-	-	4.76
11.1800	2.27	2.72	-	1.59	6.12	5.44	0.91
11.1830	-	-	-	-	-	-	4.99
11.1930	-	-	1.36	-	-	-	4.99
11.2030	-	-	-	2.04	-	-	4.76
11.2130	-	-	-	-	-	-	4.54
11.2230	-	-	-	-	-	-	4.54
11.2310	-	-	1.36	5.22	12.02	6.35	4.54
11.2350	-	-	0.45	1.13	3.40	1.59	5.44

APPENDIX G. TABLE X

SOLIDS REMOVED DURING RUN 9, KG. (RAW DATA)

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
12.0130	-	-	-	-	-	-	4.54
12.0245	-	-	0.45	1.36	-	-	4.54
12.0345	-	-	-	-	-	-	4.54
12.0450	2.27	2.72	0.68	1.36	-	-	4.54
12.0550	-	4.99	-	-	-	-	-
12.0600	-	-	0.23	1.36	4.54	4.08	0.91
12.0700	-	4.54	-	-	-	-	-
12.0805	-	4.54	-	-	-	-	-
12.1000	-	-	0.68	2.49	-	-	1.36
12.1200	1.36	1.36	0.23	0.91	3.18	4.54	0.91
12.1530	-	-	1.13	2.72	-	-	-
12.1800	1.36	1.36	0.45	0.91	4.54	3.63	-
12.2200	-	-	-	2.27	2.72	3.18	-
13.0000	1.36	1.36	1.13	1.36	1.36	1.36	1.36
13.0200	-	-	-	1.13	-	2.72	-
13.0600	-	-	-	3.18	1.81	-	-
13.0730	-	-	-	-	-	4.99	-
13.1200	1.36	1.36	1.35	2.72	3.63	4.08	0.91
14.0030	-	-	-	-	338.83	-	25.40
14.0600	-	-	-	-	-	14.97	-
14.0800	-	-	-	3.18	0.91	-	-
14.1200	2.72	1.36	0.91	1.81	0.45	0.68	0.91
14.1800	1.35	1.36	0.68	1.81	0.91	6.35	-
15.0000	0.63	0.63	-	2.27	-	4.08	2.95
15.0800	-	-	-	1.59	-	4.99	1.81
15.1030	0.63	19.85	0.45	0.68	0.45	1.81	0.83
15.1200	2.27	0.91	0.23	0.45	0.23	1.81	-
16.0430	-	-	-	2.27	2.95	16.10	-
16.0830	-	-	0.91	0.91	4.54	-	-
16.1100	-	-	0.23	0.68	1.36	6.35	-
16.1500	2.27	0.91	0.91	1.36	3.18	5.22	-
16.1945	-	-	0.45	2.04	6.80	4.99	-
17.0000	2.27	0.91	0.45	3.63	2.04	2.72	7.71
17.0600	-	-	0.45	2.95	5.67	7.03	-
17.0800	2.27	0.91	0.23	2.27	2.95	1.36	0.91
17.1110	-	-	-	-	8.16	-	-
17.1345	2.27	0.91	-	-	-	-	-
17.1545	2.27	0.91	-	-	-	-	-
17.1640	-	-	-	-	10.89	-	-
17.1700	-	-	1.36	5.90	-	6.58	0.91

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APPENDIX G. TABLE X.

SOLIDS REMOVED DURING RUN 5, KG. (RAW DATA)

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	FLUID FINES	BOILER BACK	BOILER FLUE	FLUID COARSE
17.1125	-	-	-	-	7.71	-	-
17.2015	-	-	-	-	-	-	6.35
18.0000	2.27	0.91	1.81	8.62	5.67	8.39	2.49
18.0300	2.27	0.91	-	8.39	5.90	3.63	0.91
18.0930	-	-	-	5.67	2.49	2.27	14.06
18.1130	-	-	-	2.72	-	-	2.72
18.1200	2.27	1.36	2.72	-	-	-	1.81
18.1400	-	-	-	4.54	2.27	-	4.08
18.1700	-	-	-	2.72	-	-	2.27
18.1800	-	-	-	-	-	3.18	-
18.2000	-	-	-	3.40	-	-	3.63
18.2200	-	-	-	1.81	-	-	5.44
19.0000	2.72	1.36	1.81	2.27	5.44	3.18	0.91
19.0800	2.72	1.36	0.91	2.27	7.03	4.54	0.91
19.1030	-	-	-	2.95	-	3.86	2.49
19.1330	-	-	-	2.72	4.99	-	3.18
19.1800	-	-	-	8.62	-	4.08	6.35
19.2000	-	-	1.81	4.99	-	-	2.04
19.2345	2.72	1.36	1.81	9.07	7.26	3.18	23.59
20.0230	-	-	-	7.71	-	-	-
20.0800	2.72	1.36	1.36	5.90	3.63	4.54	1.36
20.1100	-	-	1.36	9.07	-	9.30	2.72
20.1430	-	-	-	4.54	8.62	-	2.27
20.1530	-	-	1.13	1.36	-	-	2.27
20.1630	-	-	-	-	3.40	-	-
20.1800	-	-	-	-	-	14.51	-
20.1900	-	-	0.91	5.90	-	2.49	-
20.2000	-	-	-	1.36	380.81	0.23	6.80
22.1130	-	-	1.81	58.06	0.91	7.26	41.73
22.1300	-	-	1.36	9.53	-	-	-
22.1600	-	-	-	3.18	-	-	-
22.1730	-	-	1.13	-	-	-	-
22.1800	2.27	0.91	-	2.27	0.23	11.79	1.81
22.2000	-	-	-	3.86	-	-	-
22.2245	-	-	0.45	4.99	-	-	-
23.0015	2.27	0.91	0.11	2.95	0.23	2.72	0.91
23.0200	-	-	-	-	-	-	4.54
23.0300	-	-	-	5.44	-	-	4.54
23.0425	-	-	-	-	-	-	4.54
23.0800	2.27	0.91	0.23	5.90	0.68	2.27	5.44

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APPENDIX G. TABLE X.

SOLIDS REMOVED DURING RUN V, KG. (RAW DATA)

DAY.HOUR	GASFR	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
23.0700	-	-	-	-	-	-	4.54
23.0820	-	-	-	4.99	-	-	-
23.1200	0.91	0.91	-	17.24	0.91	3.18	15.88
23.1600	-	-	-	3.86	-	-	-
23.1800	0.91	0.91	-	2.27	0.45	11.34	0.91
23.2045	-	-	-	-	-	-	68.04
24.0000	0.91	0.91	0.34	4.99	1.81	2.95	0.91
24.0300	0.91	0.91	0.45	8.16	1.13	2.95	0.91
24.0600	-	-	-	2.27	-	-	-
24.0835	0.91	0.91	-	-	-	-	0.91
24.1045	-	-	-	3.63	-	-	-
24.1200	0.91	0.91	0.45	3.63	1.13	0.91	-
24.1600	-	-	-	5.44	-	-	-
24.1800	0.91	0.91	0.68	5.44	1.81	1.81	1.81
24.2000	-	-	-	5.44	-	-	-
25.0030	-	-	0.45	4.08	0.68	2.72	4.08
25.0230	-	-	-	9.07	0.45	-	5.90
25.0430	-	-	-	2.95	-	-	2.72
25.0730	-	-	-	4.31	-	-	2.49
25.1210	-	-	-	-	-	-	19.05
25.1500	41.28	-	0.91	9.07	0.91	-	-
25.2030	-	-	-	3.63	4.08	-	3.18
25.2300	-	-	-	2.27	-	-	2.27
26.0530	-	-	-	3.63	-	-	0.91
26.1200	124.74	-	-	-	41.28	-	-
26.2000	-	-	-	11.79	-	4.08	-
27.0000	-	-	-	11.79	0.91	6.58	5.44
27.0800	-	-	10.89	7.71	0.45	5.67	10.89
27.1200	0.91	0.91	1.59	4.76	1.81	5.90	0.91
27.1830	0.91	0.91	2.04	6.80	2.04	2.27	34.36
28.0000	0.91	0.91	2.27	6.35	1.59	1.59	0.91
28.0300	0.91	0.91	0.68	6.80	1.36	1.81	16.78
28.0700	-	-	-	-	-	-	3.18
28.0800	-	-	0.68	1.81	-	-	4.54
28.0900	-	-	-	-	-	-	4.54
28.1100	-	-	-	-	-	-	4.54
28.1230	-	-	-	-	-	-	4.54
28.1345	-	-	-	-	-	-	4.54
28.1400	0.91	0.91	1.13	2.72	2.72	2.04	-
28.1600	-	-	-	-	-	-	10.21

SOLIDS REMOVED DURING RUN 9, KG. (RAW DATA)

DAY.HOUR	GAS'R	REGEN	REGEN CYCLONE	ELUTR FINES	BOILER BACK	BOILER FLUE	ELUTR COARSE
28.1845	0.91	0.91	5.44	7.71	3.63	4.54	0.91
28.2045	-	-	14.51	-	-	-	-
28.2115	9.07	16.78	-	-	-	-	-
28.2300	-	17.24	-	-	-	-	-
28.2345	-	15.88	8.16	5.44	0.68	4.54	-
29.0300	-	-	-	-	20.41	-	-
29.1440	-	-	1.13	-	-	-	-
29.1600	-	-	-	-	58.97	-	-
29.1800	-	33.57	-	-	-	-	-
30.0100	-	-	0.68	3.18	-	-	-
30.0445	-	-	1.36	5.90	-	-	-
30.0600	0.91	0.91	-	1.59	7.26	16.78	0.91
30.0745	-	-	2.49	0.45	-	-	-
30.1000	-	-	6.12	0.68	3.63	2.27	11.11
30.1240	-	13.61	4.08	1.36	-	-	4.54
30.1300	-	4.54	-	1.36	-	-	1.81
30.1400	-	0.68	5.44	-	-	-	-
31.0000	0.91	0.91	3.63	11.34	7.26	5.90	0.91
31.0600	0.91	0.91	6.80	1.81	5.44	2.72	0.91
31.0800	-	-	3.18	-	-	-	-
31.0900	-	2.72	-	-	-	-	-
31.1000	-	4.54	0.91	1.36	0.91	5.90	-
31.1600	-	36.29	-	-	-	-	-
31.1700	-	-	-	3.18	-	-	-
31.2000	-	-	5.22	-	-	-	-
31.2030	-	-	-	8.16	6.35	7.03	-
32.0000	0.91	11.79	0.91	7.71	4.54	2.27	1.36
32.0600	0.91	0.91	0.45	12.25	3.63	2.72	-
32.0930	118.04	-	-	-	-	-	-

Appendix G. - Table XI

Run 9 - Gasifier Bed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY: TIME	3350 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT.								
51554	3:1000	.1	7.6	11.1	25.6	27.0	27.0	.3	.1	.1
51559	4:0430	.5	7.6	10.9	24.5	26.4	29.7	.1	.1	.1
51562	5:0001	.9	8.4	11.5	24.0	25.2	29.4	.5	.0	.0
51561	5:0400	.8	7.6	10.6	24.5	26.1	29.9	.6	.0	.0
51570	5:1400	.4	6.5	9.4	25.9	28.0	31.0	.7	.1	.1
51574	5:2359	.8	8.4	11.0	26.4	27.9	25.5	.0	.0	.0
51580	6:0400	.3	9.3	10.6	27.0	27.9	23.0	.4	.1	.0
51585	6:1000	.5	10.0	14.0	28.4	28.9	20.3	.5	.0	.0
51586	6:2100	.2	11.1	14.1	28.6	27.3	17.5	.1	.1	.1
51591	7:0400	.8	7.4	13.0	28.3	28.4	20.4	.1	.0	.1
51594	7:1000	.3	9.5	12.4	26.0	27.0	23.5	.3	.0	.0
51598	7:1800	.8	10.3	12.4	26.9	25.6	23.4	.0	.0	.0
51604	8:0400	.8	9.8	13.0	29.0	28.1	19.1	.1	.0	.0
51603	7:2350	.8	10.8	12.1	27.1	28.0	24.0	.0	.0	.1
51610	8:1005	.8	14.0	9.5	32.4	29.1	18.4	.0	.0	.0
51615	8:1000	.9	11.0	13.0	28.9	28.7	16.5	.1	.0	.0
51617	9:0000	.8	10.8	14.0	28.5	27.3	14.5	.1	.0	.0
51620	9:1070	.8	10.0	13.5	29.9	28.6	16.7	.0	.0	.0
51623	9:1000	.8	11.7	14.4	30.4	28.1	14.9	.1	.0	.0
51631	10:0015	.8	10.3	14.9	30.7	28.1	15.0	.1	.0	.0

Appendix G. - TABLE XI

Run 5 - Gasifier Bed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY: TIME	3000 2000	2000 1400	1400 1100	1100 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
51633	10:1200	.0	10.0	13.2	27.5	30.4	16.7	.1	.0	.0
51634	10:1600	.0	10.5	13.4	29.6	30.3	15.7	.0	.0	.0
51646	11:0300	.0	11.1	14.3	30.7	29.7	13.9	.1	.0	.0
51648	11:1200	.1	8.7	12.9	30.1	31.9	16.1	.1	.0	.0
51651	11:1600	.0	9.1	10.9	29.9	31.5	18.0	.0	.0	.0
51659	11:2000	.1	10.0	13.5	31.5	30.6	13.7	.1	.0	.1
51660	12:0400	.1	9.4	13.3	30.9	31.0	15.0	.1	.0	.0
51664	12:1000	.0	8.6	12.0	30.5	30.0	15.0	.1	.1	.0
51671	12:1600	.1	8.6	12.0	30.7	31.0	16.0	.1	.0	.0
51676	12:2000	.1	10.3	14.3	31.1	29.0	14.0	.1	.0	.0
51683	13:0400	.0	10.4	15.7	30.7	27.6	16.0	.0	.0	.0
51692	13:1200	.1	9.6	14.8	31.1	30.1	14.5	.1	.0	.0
51693	14:0000	.1	10.6	14.9	33.0	29.7	11.7	.0	.0	.0
51696	14:1100	.0	10.7	14.8	30.0	30.0	16.6	.1	.0	.0
51701	14:1000	.0	9.9	14.5	30.3	30.0	13.0	.1	.0	.0
51704	14:1000	.1	10.0	14.6	30.3	27.5	16.5	.1	.0	.0
51708	14:2000	.0	11.0	14.7	33.9	29.0	11.1	.1	.0	.1
51716	15:0100	.0	9.5	14.1	31.0	30.0	13.7	.1	.0	.0
51705	15:1000	.0	9.3	14.1	30.4	31.0	15.0	.1	.0	.0

Appendix G. - Table XI

Run 9 - Gasifier Bed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY: TIME	3350 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 106	106
		WT. PERCENT								
51730	16:2359	.0	8.8	10.7	33.8	33.7	12.4	.1	.0	.0
51731	16:1500	.0	6.9	10.8	33.8	34.8	12.8	.1	.0	.1
51739	17:0800	.1	7.5	12.4	32.8	34.7	12.4	.1	.0	.0
51746	17:1045	.1	8.1	13.4	33.4	33.4	11.3	.1	.0	.1
51749	17:1545	.1	7.9	13.1	33.2	33.9	11.6	.1	.0	.1
51831	17:2359	.0	6.5	11.0	32.8	36.6	13.1	.0	.0	.0
51839	18:0800	.1	5.4	10.4	32.8	37.5	14.0	.1	.0	.1
51841	18:1200	.1	7.4	13.4	35.5	32.4	10.9	.0	.0	.1
51848	18:1600	.0	5.4	10.5	31.8	36.8	15.6	.0	.0	.1
51852	18:2359	.1	5.3	10.9	31.5	37.2	14.8	.1	.0	.0
51858	19:0800	.1	5.9	11.6	32.9	36.3	12.8	.1	.0	.0
51863	19:1200	.1	5.7	10.9	31.8	36.4	14.7	.3	.0	.1
51866	19:1600	.1	5.8	10.3	30.8	35.8	17.9	.0	.0	.1
51870	19:2359	.0	3.8	7.5	26.3	38.8	24.3	.7	.0	.1
51880	20:0800	.1	4.6	9.0	28.0	35.6	21.5	.5	.1	.1
51885	20:1100	.0	5.8	10.1	30.1	35.6	18.4	.8	.1	.1
51887	20:1600	.0	4.5	9.8	29.8	36.4	20.1	.8	.1	.1
51893	20:1800	.1	5.4	9.9	30.8	35.4	17.6	.6	.0	.0
51908	22:0015	.0	6.8	11.8	32.5	34.9	15.1	.8	.1	.0

Appendix G. - Table XT

Run 9 - Gasifier Bed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	[illegible] 2000	2000 1400	1400 1100	1100 850	850 600	600 250	250 150	150 100	100
				WT. PERCENT						
31985	03:0600	.0	7.4	10.5	33.7	33.5	15.0	.1	.0	.0
31986	03:1000	.0	7.9	13.4	36.6	27.6	14.0	.1	.0	.0
31989	03:1850	.1	7.7	10.6	33.7	33.7	10.0	.1	.0	.0
31910	03:2359	.0	6.0	11.5	30.5	35.7	14.0	.0	.0	.0
31908	04:0600	.0	8.4	10.0	30.9	34.0	15.4	.0	.0	.1
31925	04:0900	.0	7.3	13.4	30.6	33.1	13.1	.1	.1	.0
31927	04:1000	.1	7.7	13.5	33.0	30.7	10.9	.0	.0	.0
31934	04:1800	.1	8.0	11.1	30.7	35.0	17.0	.1	.0	.0
31938	04:2359	.1	7.0	10.6	30.0	33.0	15.0	.1	.0	.0
31945	05:0600	.0	6.3	10.1	31.7	34.0	15.6	.0	.0	.0
31951	06:0001	.1	6.7	10.4	30.3	33.7	14.0	.0	.0	.0
31958	06:0600	.0	6.9	10.0	31.7	30.5	15.7	.0	.0	.0
31960	07:0600	.0	5.9	10.0	29.3	33.4	19.0	.0	.1	.0
31970	07:1000	.0	8.9	13.4	31.9	30.6	14.0	.0	.0	.0
32006	07:1830	.1	7.0	10.5	31.0	32.4	16.5	.0	.0	.1
32004	07:2359	.0	6.3	11.5	30.0	33.4	17.6	.0	.0	.1
32011	08:0600	.0	7.1	10.0	30.6	31.0	17.9	.4	.0	.1
32020	08:1400	.0	7.6	10.4	31.0	31.0	16.0	.1	.0	.0
32023	08:1845	.1	5.5	9.9	28.5	34.0	21.0	.4	.0	.0

Appendix G. - Table XI

Run 9 - Gasifier Bed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE	DAY-	3360	2000	1400	1100	850	600	250	150	100
NUMBER	TIME	2000	1400	1100	850	600	250	150	100	
		WT. PERCENT								
50027	30:0400	.0	5.9	10.7	25.3	34.8	19.7	.2	.1	.0
50031	30:1400	.0	4.8	8.8	25.3	33.0	26.5	1.3	.1	.0
50035	30:1800	.0	5.7	7.8	26.1	31.5	25.4	1.8	.0	.0
50039	30:2359	.1	4.9	9.1	26.0	33.1	25.5	.4	.0	.1
50046	31:0400	.1	4.6	8.8	26.1	33.0	27.0	.4	.0	.0
50051	31:1000	.1	4.5	8.5	24.0	31.8	29.1	1.3	.1	.3
50054	31:1800	.1	5.0	8.5	23.0	30.1	29.9	4.1	.3	.4
50060	31:2359	.0	5.1	8.5	23.8	30.8	30.3	1.9	.0	.0
50067	32:0400	.0	5.7	8.8	24.4	30.9	29.8	.0	.0	.0

APPENDIX G TABLE XII

RUN 9 - Regenerator Bed Particle Distribution

SAMPLE NUMBER	DAY-TIME	SIEVE SIZE IN MICRONS 3360-2000	2000-1400	1400-1180	1180-850	850-600	600-250	250-150	150-100	100
		WT. PERCENT.								
51557	3:1800	.8	6.4	11.8	25.6	27.8	26.9	.7	.1	.1
51560	4:0430	.3	8.6	11.1	24.3	25.8	21.6	1.8	.0	.0
51566	5:0400	.8	7.8	10.8	23.4	25.7	21.8	1.9	.1	.1
51569	5:0001	.8	7.8	10.4	23.5	26.3	21.5	.9	.1	.0
51577	5:0300	.4	8.4	11.3	25.7	27.3	20.6	.3	.1	.0
51574	5:1400	.8	8.3	11.8	25.4	26.9	17.4	.5	.1	.1
51584	6:0400	.8	10.8	10.9	28.4	26.1	21.4	.3	.0	.0
51586	6:1000	.5	10.4	12.4	27.9	25.9	20.4	.5	.0	.0
51589	6:2100	.8	13.8	13.1	28.6	29.9	18.5	.8	.0	.0
51590	7:0400	.1	7.8	12.8	27.9	30.8	21.1	.4	.1	.0
51595	7:1000	.8	9.6	12.9	28.8	26.9	20.9	.8	.0	.0
51599	7:1800	.8	10.4	13.8	28.6	24.8	20.4	1.8	.0	.0
51604	8:0001	.6	11.6	14.1	29.1	27.8	17.7	.1	.0	.0
51611	8:1000	.8	10.6	14.6	28.9	26.6	17.8	.1	.0	.0
51614	8:1800	.8	10.8	14.8	29.1	27.9	16.5	.1	.0	.0
51618	9:0000	.5	11.5	14.5	30.1	28.8	15.7	.1	.0	.0
51624	9:1000	.5	10.5	14.7	30.8	27.8	14.6	.1	.0	.0
51628	10:0415	.5	4.8	16.7	30.1	29.4	14.5	.8	.0	.0
51634	10:1000	.8	11.1	14.0	30.8	29.3	15.1	.1	.0	.0

APPENDIX G TABLE XII

RUN 9 -REGENERATOR FED PARTICLE DISTRIBUTION

SIEVE SIZE IN MICRONS

SAMPLE	DAY-	3360	2000	1400	1100	850	600	250	150	100
NUMBER	TIME	2000	1400	1100	850	600	250	150	100	
				WT. PERCENT						
51645	10:0359	.0	10.0	14.3	30.7	29.4	15.1	.2	.3	.0
51647	11:0159	.1	11.2	14.9	30.9	29.5	13.5	.0	.0	.0
51649	11:1000	.0	11.0	14.0	30.9	28.9	13.7	.1	.0	.0
51653	12:0400	.0	12.0	15.4	31.7	28.6	12.8	.0	.0	.0
51657	8:0400	.0	9.5	12.1	30.3	28.8	20.9	.2	.0	.0
51661	9:1000	.0	9.6	13.1	29.6	27.5	16.8	.2	.0	.0
51637	10:1000	.0	11.0	14.1	29.8	29.7	15.1	.1	.0	.0
51658	11:1000	.1	10.0	13.6	30.0	31.1	14.7	.1	.0	.0
51659	11:0359	.1	11.6	14.8	31.3	29.4	12.7	.0	.0	.0
51665	10:1000	.0	10.1	14.9	31.9	28.6	12.3	.0	.0	.0
51670	10:1000	.1	10.5	14.5	30.9	29.9	14.8	.1	.0	.0
51677	12:0359	.0	9.4	14.8	29.0	28.8	13.8	.0	.0	.0
51684	13:0400	.0	13.0	13.9	33.3	27.8	9.1	.1	.0	.0
51684	13:1000	.0	14.1	13.6	30.6	30.5	14.3	.1	.0	.0
51694	14:0400	.0	9.6	13.8	31.4	28.9	14.8	.0	.0	.0
51697	14:1000	.1	9.8	13.8	30.1	31.4	13.3	.1	.0	.0
51709	14:0359	.0	11.7	15.6	30.1	28.6	16.6	.0	.0	.1

APPENDIX G. TABLE XII
RUN 9 - Regenerator Bed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	3000 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
51717	15:0700	.0	8.5	10.0	30.6	38.6	15.4	.0	.0	.0
51724	15:1900	.1	9.3	10.8	31.8	30.9	15.9	.0	.0	.0
51730	16:1500	.1	6.5	10.6	26.0	38.3	16.1	.0	.0	.0
51733	16:2359	.0	7.8	10.8	30.9	33.5	18.7	.1	.0	.0
51740	17:1000	.1	7.0	10.3	30.8	34.4	12.9	.1	.0	.0
51741	17:1045	.0	8.5	10.6	30.1	30.9	11.7	.1	.0	.0
51748	17:1045	.1	8.3	10.1	33.4	34.1	11.9	.1	.0	.0
51830	17:2359	.1	7.5	10.4	30.9	34.4	10.7	.1	.0	.0
51840	18:0600	.1	5.1	10.1	31.6	37.9	15.8	.0	.0	.0
51840	18:1200	.1	4.4	9.7	30.8	39.0	15.6	.1	.0	.0
51849	18:1800	.1	6.6	10.4	34.4	35.4	11.1	.1	.0	.0
51853	18:2359	.1	5.7	10.8	31.5	37.8	14.7	.1	.0	.0
51859	19:0600	.1	5.0	10.7	31.6	37.1	15.3	.0	.0	.0
51864	19:1000	.1	5.1	10.9	30.5	37.8	14.8	.1	.0	.0
51869	19:1800	.1	4.8	9.7	29.0	37.8	18.9	.5	.0	.1
51877	19:2359	.1	3.3	7.6	25.9	37.9	24.7	.4	.0	.0
51881	20:0600	.0	4.8	8.6	27.1	37.8	21.7	.3	.0	.0
51886	20:1000	.0	5.3	10.6	30.1	35.4	18.8	.0	.0	.0

Appendix G. Table XII

Run 9 - Regenerator Bed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	3000 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
S1000	02:1000	.4	6.0	10.6	20.5	34.0	17.9	.0	.0	.0
S1075	02:1600	.0	7.0	11.6	21.5	33.0	15.9	.0	.0	.0
S1099	03:0015	.0	6.4	10.4	21.0	35.7	16.6	.0	.0	.0
S1974	03:0800	.0	8.0	13.0	20.9	30.9	11.0	.0	.0	.0
S1907	03:1000	.1	7.5	10.6	20.1	33.4	14.3	.0	.0	.0
S1916	03:1600	.0	6.0	10.0	20.6	36.5	14.1	.0	.0	.0
S1913	03:0359	.1	6.0	9.9	20.5	37.6	15.0	.1	.0	.0
S1921	04:0800	.0	7.5	13.3	20.0	30.0	10.7	.1	.0	.0
S1995	04:0700	.0	6.9	11.4	20.5	30.0	13.7	.1	.0	.0
S1900	04:1000	.0	7.5	10.0	20.0	33.1	15.0	.0	.0	.0
S1935	04:1600	.0	7.0	10.0	20.0	30.0	14.0	.0	.0	.0
S19[illegible]	04:0359	.0	7.0	10.6	20.0	30.0	15.4	.0	.0	.0
S19[illegible]	05:0800	.1	7.1	10.7	21.7	30.5	15.6	.0	.0	.0
S19[illegible]	06:0001	.0	8.0	14.0	24.0	31.7	15.6	.0	.0	.0
S19[illegible]	06:0800	.1	6.1	10.0	24.9	34.0	11.0	.0	.0	.0
S1971	07:0001	[illegible]	10.0	10.0	20.5	31.9	9.1	.0	.0	.0
S1971	07:1000	.0	7.0	10.0	20.7	31.9	17.0	.0	.0	.0
S[illegible]	07:1600	.1	7.6	10.0	20.9	31.5	16.6	.1	.0	.0
S[illegible]	07:0359	.0	6.9	11.0	20.1	30.5	17.0	.0	.0	.1

APPENDIX G. TABLE XII
RUN 9 - REGENERATOR BED PARTICLE DISTRIBUTION

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY: TIME	3350 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
90019	29:0800	.0	4.7	11.1	29.8	31.8	20.8	1.1	.0	.1
90022	29:1845	.0	4.6	11.4	29.4	31.7	19.4	1.1	.0	.0
90028	30:0800	.0	5.7	9.9	27.6	32.0	22.9	.9	.1	.0
90030	30:1200	2.0	12.8	10.8	24.5	24.5	18.4	6.0	.0	.0
90036	30:1800	.1	3.4	6.6	23.8	35.0	27.9	1.3	.0	.0
90040	30:2359	.1	4.4	8.6	25.0	38.7	22.0	.9	.0	.0
90047	31:0400	.1	4.6	8.9	26.1	30.7	26.3	1.3	.1	.0
90050	31:1200	.1	3.7	7.1	30.0	26.8	26.6	2.0	.4	.0
90057	31:1800	.1	4.0	8.4	29.7	29.3	26.6	3.5	.0	.3
90061	31:2359	.5	7.6	10.1	6.6	36.7	33.9	2.4	.0	.0
90067	32:0400	.6	4.4	9.8	24.5	29.4	28.1	1.1	.0	.0

APPENDIX G TABLE XIII

RUN 9 - Elutriator Coarse Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY: TIME	3360 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
51555	2:1000	.0	.0	.3	.0	1.4	22.5	37.3	9.1	28.5
51556	4:0400	.0	.9	1.0	5.0	7.6	40.3	30.6	4.3	7.5
51564	5:0801	.1	1.7	3.0	7.8	11.7	48.0	22.1	2.1	3.0
51566	5:0800	.0	1.7	2.8	7.0	10.3	48.8	27.4	2.0	0.5
51570	5:1400	.1	2.1	3.4	9.6	15.8	49.9	15.4	1.3	2.3
51576	5:2359	.0	3.0	5.4	14.0	20.0	47.4	7.9	.6	.5
51580	6:0400	.2	4.0	5.7	14.5	19.6	44.0	18.1	.0	1.0
51587	6:1600	.1	4.3	5.6	14.3	19.0	30.7	13.1	1.5	3.3
51593	7:0403	.0	0.6	4.0	9.6	18.6	36.3	22.3	5.4	7.3
51596	7:1000	.0	1.7	3.0	8.0	11.0	40.4	24.0	5.0	5.6
51600	7:1600	.1	3.4	5.0	13.1	17.1	36.6	15.7	3.7	5.0
51604	8:0400	.0	3.3	5.7	16.4	24.3	38.1	7.0	1.0	3.0
51610	8:1000	.1	6.5	8.7	20.4	27.9	30.4	3.0	.0	.9
51605	8:0001	.0	6.1	7.5	21.0	27.1	35.0	1.7	.1	.3
51618	8:1200	.0	5.0	7.0	19.0	26.6	33.9	4.6	1.1	1.0
51619	8:2000	.1	5.0	7.0	22.6	26.7	30.0	5.5	1.4	1.9
51620	9:1000	.0	6.6	8.9	22.1	24.6	29.3	6.3	1.6	1.8
51625	9:1600	.1	5.9	8.0	19.3	24.0	25.0	7.4	2.3	3.7
51629	10:0615	.2	5.9	8.7	21.6	29.1	31.5	2.9	.0	.0

APPENDIX G TABLE XIII

RUN 9 - Elutriator Coarse Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY: TIME	3350 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
61635	10:1800	.1	5.8	8.5	21.9	28.9	30.4	3.6	.3	.5
61636	10:1800	.1	7.8	10.1	24.5	29.3	25.8	2.9	.4	.4
61643	10:2359	.1	5.8	7.8	29.8	29.9	25.8	3.8	.5	.3
61650	11:1000	.1	5.7	6.8	28.8	30.4	27.9	3.3	.7	.9
61653	11:1800	.1	5.6	8.5	28.7	30.6	27.1	4.2	.8	.4
61660	11:2359	.1	5.6	8.9	24.8	30.8	27.8	1.8	.1	.8
61661	12:0000	.1	6.1	9.4	24.3	29.3	27.7	2.4	.4	.3
61666	12:1800	.1	4.7	7.7	21.6	31.2	29.8	3.5	.8	.6
61670	12:2359	.0	6.6	9.3	28.8	28.7	26.9	4.8	.8	.8
61685	13:0000	.1	5.5	8.5	23.8	30.9	27.5	3.8	.5	.3
61688	13:1800	.0	3.6	6.8	21.3	35.8	30.4	3.1	1.3	.5
61695	14:0000	.0	5.7	8.8	20.1	24.8	31.6	9.2	.8	.8
61699	14:1800	.1	6.6	9.8	27.3	31.6	29.7	1.7	.8	.1
61710	14:2359	.1	5.8	8.3	23.8	31.1	26.9	3.7	1.1	.7
61718	15:0700	.0	4.3	7.6	21.6	30.6	29.4	4.5	1.2	1.0
61734	16:2359	.3	3.1	6.7	24.1	36.8	24.6	1.9	1.8	2.8
61741	17:0000	.8	5.3	9.8	26.1	33.5	21.8	2.8	.7	1.7
61829	17:1700	.8	4.3	7.3	20.8	30.4	26.4	2.6	1.1	3.7
61835	17:2359	.0	2.7	5.3	17.3	25.4	25.9	7.3	4.8	11.8

APPENDIX G TABLE XIII

RUN 9 - Elutriator Coarse Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY: TIME	3350 2000	2000 1400	1400 1180	1180 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

APPENDIX G TABLE XIV

RUN 9 - Stone Feed Particle Distribution

SIEVE SIZE IN MICRONS

SAMPLE NUMBER	DAY-TIME	3200 2000	2000 1400	1400 1150	1150 850	850 600	600 250	250 150	150 100	100
		WT. PERCENT.								
51237	.0000	.3	1.1	7.2	15.8	18.1	26.8	14.8	3.9	2.7
51237	7.1000	.2	8.8	4.7	13.9	16.4	35.1	14.5	2.5	2.8
51675	12.1200	.4	19.8	15.5	38.5	18.1	10.7	2.4	.5	.9
51715	14.0057	.8	23.8	17.4	47.5	9.5	1.3	.2	.0	.2
[illegible]	21.1000	.3	10.8	11.4	28.1	16.4	28.3	4.8	1.7	1.9

APPENDIX G TABLE XV

TRACE ELEMENT ANALYSIS BY NEUTRON ACTIVATION - RUN 9

(a) Fuel Oil

Isotope	Photon Energy (keV)	Half-Life	Content (ppm)	Limit (ppm)
^{76}As	560	26.3 Hrs	/-	10-100
^{115}Cd (115 In)	337	53.5 hrs	7 ± 1.4	0.1
^{60}Co	1173;1332	5.24 yrs	0.2±.04	0.01
^{51}Cr	320	27.8 days	1.4±.14	0.3
^{203}Hg	279	46.9 days	*	*
^{99}Mo (^{99}Tc)	141	66.7 hrs	< 10	~ 10
^{56}Mn	847;1811	2.58 hrs	0.9± .18	0.5
^{65}Ni	367;1115;1482	2.56 hrs	< 5	~ 5
^{122}Sb	564;693	2.75 days	< 1	~ 1
^{124}Sb	603;723	60.9 days	< 1	~1
^{75}Se	136;265;280	121 days	*	*
^{127m}Te	361	105 days	< 1	~ 1

APPENDIX C. TABLE XV

TRACE ELEMENT ANALYSIS BY NEUTRON ACTIVATION - RUN 9

(b) Fresh Limestone.

Isotope	Photon Energy (keV)	Half-Life	Content (ppm)	Limit (ppm)
^{76}As	559	26.3 Hrs	/-	10-100
^{115}Cd (115 In)	337	53.5 Hrs	20± 6	10
^{60}Co	1173;1332	5.25 yrs	0.3±.01	0.01
^{51}Cr	320	27.8 days	2 ± .8	0.3
^{203}Hg	279	46.9 days	*	*
^{99}Mo (99 Tc)	141	66.7 hrs	ø	>100
^{56}Mn	847;1811	2.58 hrs	20 ± 1	0.5
^{65}Ni	367;1115;1480	2.56 hrs	<50	~ 50
^{122}Sb	564;693	2.75 days	<10	~10
^{124}Sb	603;723	60.9 days	<10	~ 10
^{75}Se	136; 265; 280	121 days	*	*
^{127m}Te	361	105 days	2 ± .4	~ 1

/- Arsenic could not be measured because of interference from antimony and bromine. A correction could not be applied because the antimony and bromine activities were too low to measure accurately.

* Mercury and selenium mutually interfered at 280 keV. Other selenium peaks could not be measured with any degree of certainty.

ø Molybdenum was obscured by large ^{47}Ca peak arising from calcium matrix.

APPENDIX Q. TABLE XVI

Spark-Source Mass Spectrometric Analysis - Run 9.

Oil Sample

ELEMENT	PROBABLE RANGE		
Lithium	Less than		0,05 PPM 1
Beryllium	Less than		0,01 PPM 1
Boron	Less than		0,001 PPM
Fluorine	0.001 PPM	-	0,01 PPM
Sodium	8 PPM	-	80 PPM
Magnesium	1 PPM	-	10 PPM
Aluminium	1 PPM	-	10 PPM
Silicon	1 PPM	-	10 PPM
Phosphorus	0,3 PPM		3 PPM
Sulphur	6 PPM		60 PPM
Chlorine	0.06 PPM		0,6 PPM
Potassium	0.3 PPM		3 PPM
Calcium	8 PPM		80 PPM
Scandium	Less than		0.08 PPM 1
Titanium	0.1 PPM		1 PPM
Vanadium	100 PPM		1000 PPM
Chromium	0.03 PPM		0.3 PPM
Manganese	0.06 PPM		0.6 PPM
Iron	3 PPM		30 PPM
Cobalt	0,1 PPM		1 PPM
Nickel	6 PPM		60 PPM
Copper	0.1 PPM		1 PPM
Zinc	0.3 PPM		3 PPM
Gallium	0.08 PPM		0.8 PPM
Germanium	Less than		0.8 PPM 1
Arsenic	0,3 PPM		3 PPM
Selenium	Less than		0.06 PPM 1
Bromine	Less than		0.008 PPM 1
Rubidium	Less than		0.03 PPM 1
Strontium	Less than		0.8 PPM 1
Yttrium	.0003 PPM		0.003 PPM
Zirconium	Less than		0.08 PPM 1
Niobium	less than		0.001 PPM
Molybdenum	0.1 PPM		1 PPM
Ruthenium	Less than		0,008 PPM 1
Rhodium	Less than		0.03 PPM 1
Palladium	Less than		0.008 PPM 1

APPENDIX G., TABLE XVI

SPARK SOURCE MASS SPECTROMETRIC ANALYSIS - RUN 9

Oil Sample (contd)

Element	Probable Range	
Cadmium	Less than	0.06 PPM I
Indium	Less than	0.03 PPM I
Tin	0.2 PPM	2 PPM
Antimony	0.01 PPM	0.1 PPM
Tellurium	Less than	0.006 PPM I
Iodine	Less than	0.001 PPM
Barium	0.06 PPM	0.6 PPM
Lanthanum	.0009 PPM	0.009 PPM
Cerium	Less than	0.006 PPM I
Praseodymium	Less than	0.001 PPM
Neodymium	Less than	0.008 PPM I
Terbium	Less than	0.008 PPM I
Dysprosium	Less than	0.01 PPM I
Hafnium	Less than	0.003 PPM I
Tantalum	Less than	0.09 PPM I
Tungsten	Less than	0.003 PPM I
Gold	0.008 PPM	0.08 PPM
Lead	0.3 PPM	3 PPM

Internal standard - Silver
Assumed concentration = 0.8973E-04M
Dilution factor = 1.0000

I= Interference by complex ions suspected or known

All elements from at. No. 3 - 92 (with exception of C,H, & O) looked for; conc. in PPM and % WT/WT

Unquoted elements were below the detection limit (.01-.1 PPM)

APPENDIX G. TABLE XVI

SPARK SOURCE MASS SPECTROMETRIC ANALYSIS - RUN 9

Fresh BCR 1359 Limestone (cont)

Element	Probable Range			
Silver	Less than	0.6	PPM	I
Cadmium	Less than	0.3	PPM	I
Indium	Less than	6	PPM	I
Tin	Less than	1	PPM	I
Antimony	Less than	0.3	PPM	I
Tellurium	Less than	0.8	PPM	I
Iodine	1 PPM	10	PPM	
Cesium	Less than	0.08	PPM	I
Barium	30 PPM	300	PPM	
Lanthanum	0.3 PPM	3	PPM	
Cerium	Less than	3	PPM	I
Praseodymium	Less than	0.3	PPM	I
Neodymium	Less than	8	PPM	I
Samarium	Less than	1	PPM	I
Europium	Less than	1	PPM	I
Gadolinium	Less than	1	PPM	I
Terbium	Less than	0.2	PPM	I
Dysprosium	Less than	2	PPM	I
Tantalum	Less than	2	PPM	I
Gold	Less than	0.6	PPM	I
Lead	Less than	3	PPM	I
Thorium	Less than	0.6	PPM	I
Uranium	Less than	0.6	PPM	I

Internal standard calcium
Assumed concentration = 0.71475 OF %
Dilution factor = 1.0000

I = Interference by complex ions suspected or known -
All elements from at. No. 3 - 92 (with exception of C,N & O) looked for - Conc. in PPM and % WT/WT.

Unquoted elements were below the detection limited (.01-.1 PPM)

APPENDIX G TABLE XVI

Spark-Source Mass Spectrometric Analysis - Run 9

Fresh BCR 1359 Limestone:

Element	Probable Range
Beryllium	Less than 2 PPM 1
Boron	Less than 6 PPM 1
Fluorine	Less than 2 PPM 1
Sodium	10 PPM - 100 PPM
Magnesium	0.2% 2%
Aluminium	800 PPM 2500 PPM
Silicon	600 PPM 6000 PPM
Phosphorus	1 PPM 10 PPM
Sulphur	Less than 20 PPM 1
Chlorine	10 PPM 100 PPM
Potassium	100 PPM 1000 PPM
Scandium	Less than 0.3 PPM 1
Titanium	0.6 PPM - 6 PPM
Vanadium	0.06 PPM 0.6 PPM
Chromium	Less than 20 PPM 1
Manganese	6 PPM 60 PPM
Iron	800 PPM 8000 PPM
Cobalt	Less than 20 PPM
Nickel	Less than 6 PPM 1
Copper	Less than 2 PPM 1
Zinc	Less than 30 PPM 1
Gallium	Less than 0.6 PPM 1
Germanium	Less than 1 PPM 1
Arsenic	Less than 6 PPM 1
Selenium	Less than 3 PPM 1
Bromine	Less than 0.3 PPM 1
Rubidium	Less than 2 PPM 1
Strontium	100 PPM 1000 PPM
Yttrium	Less than 2 PPM 1
Zirconium	Less than 2 PPM 1
Niobium	Less than 0.3 PPM 1
Molybdenum	Less than 2 PPM 1
Ruthenium	Less than 1 PPM 1
Rhodium	Less than 0.1 PPM 1
Palladium	Less than 1 PPM 1

APPENDIX G TABLE XVI

Spark- Source Mass Spectrometric Analysis - Run 9

Gasifier Bed (Sampled 13.0000)

Element	Probable Range	
Beryllium	Less than	10 PPM 1
Boron	Less than	20 PPM 1
Fluorine	0.2 PPM	2 PPM
Sodium	30 PPM	300 PPM
Magnesium	0.2%	2 %
Aluminium	0.2%	2 %
Silicon	0.2%	2 %
Phosphorus	3 PPM	30 PPM
Sulphur	0.1%	1 %
Chlorine	3 PPM	30 PPM
Potassium	10 PPM	100 PPM
Scandium	Less than	0.1 PPM 1
Titanium	2 PPM	20 PPM
Vanadium	600 PPM	6000 PPM
Chromium	0.6 PPM	6 PPM
Manganese	6 PPM	60 PPM
Iron	200 PPM	2000 PPM
Cobalt	2 PPM	20 PPM
Nickel	60 PPM	600 PPM
Copper	0.2 PPM	2 PPM
Zinc	Less than	20 PPM 1
Gallium	1 PPM	10 PPM 1
Germanium	Less than	1 PPM 1
Arsenic	Less than	6 PPM 1
Selenium	Less than	3 PPM 1
Bromine	Less than	0.2 PPM 1
Rubidium	Less than	0.2 PPM 1
Strontium	100 PPM	1000 PPM
Yttrium	Less than	1 PPM 1
Zirconium	Less than	6 PPM 1
Niobium	Less than	0.3 PPM 1
Molybdenum	Less than	20 PPM 1
Palladium	Less than	1 PPM 1

APPENDIX G TABLE XVI

Spark-Source Mass Spectrometric Analysis - Run 9

Gasifier Bed (Sampled 13.0000) Contd.

Element	Probable Range		
Silver	Less than	0.8	PPM 1
Indium	Less than	1	PPM 1
Tin	Less than	1	PPM 1
Antimony	Less than	0.3	PPM 1
Tellurium	Less than	3	PPM 1
Cesium	Less than	0.06	PPM 1
Barium	100 PPM	1000	PPM
Lathanum	0.3 PPM	3	PPM
Cerium	Less than	3	PPM 1
Praseodymium	Less than	0.3	PPM 1
Neodymium	Less than	6	PPM 1
Samarium	Less than	1	PPM 1
Europium	Less than	0.3	PPM 1
Gadolinium	Less than	3	PPM 1
Terbium	Less than	0.8	PPM 1
Dysprosium	Less than	1	PPM 1
Holmium	Less than	0.8	PPM 1
Erbium	Less than	0.6	PPM 1
Ytterbium	Less than	0.6	PPM 1
Tantalum	Less than	0.6	PPM 1
Gold	Less than	0.8	PPM 1
Thorium	Less than	0.8	PPM 1
Uranium	Less than	0.8	PPM 1

Internal standard Calcium
Assumed concentration = 0.6700E UGM
Dilution factor = 1.0000
1. Interference by complex ions suspected or known.
All elements from AT. No. 3 - 92 (with exception of C,N & O) looked for - Done in PPM and % WT/WT - Unquoted elements were below the detection limit (.01-.1 PPM)

APPENDIX G TABLE XVI

Spark - Source Mass Spectrometric Analysis - Run 9

Boiler Cyclone Flues (Sampled 13.0000)

Element	Probable Range.			
Beryllium	Less than	3	PPM	1
Boron	Less than	0.6	PPM	1
Fluorine	6 PPM	60	PPM	
Sodium	100 PPM	1000	PPM	
Magnesium	600 PPM	6000	PPM	
Aluminium	600 PPM	6000	PPM	
Silicon	0.6%	6	%	
Phosphorus	10 PPM	100	PPM	
Sulphur	0.3 %	3	%	
Chlorine	300 PPM	3000	PPM	
Potassium	600 PPM	6000	PPM	
Scandium	Less than	1	PPM	1
Titanium	6 PPM	60	PPM	
Vanadium	0.3%	3	%	
Chromium	6 PPM	60	PPM	
Manganese	20 PPM	200	PPM	
Iron	600 PPM	6000	PPM	
Cobalt	60 PPM	600	PPM	
Nickel	600 PPM	6000	PPM	
Copper	10 PPM	100	PPM	
Zinc	Less than	300	PPM	1
Gallium	Less than	30	PPM	1
Germanium	Less than	3	PPM	1
Arsenic	6 PPM	60	PPM	
Selenium	Less than	10	PPM	1
Bromine	Less than	3	PPM	1
Rubidium	Less than	6	PPM	1
Strontium	100 PPM	1000	PPM	
Yttrium	Less than	3	PPM	1
Zirconium	Less than	6	PPM	1
Niobium	Less than	1	PPM	1
Molybdenum	20 PPM	200	PPM	
Ruthenium	Less than	0.3	PPM	1
Rhodium	Less than	10	PPM	1
Palladium	Less than	1	PPM	1

APPENDIX G TABLE XVI

Spark-Source Mass Spectrometric Analysis - Run 9

Boiler Cyclone Fines (Sampled 13.0000) contd.

Element	Probable Range.		
Silver	Less than	8	PPM 1
Cadmium	Less than	0.3	PPM 1
Indium	10 PPM	100	PPM
Tin	Less than	30	PPM 1
Antimony	1 PPM	10	PPM
Tellurium	Less than	1	PPM 1
Iodine	Less than	3	PPM 1
Caesium	Less than	0.6	PPM 1
Barium	30 PPM	300	PPM
Lanthanum	0.3 PPM	3	PPM
Cerium	Less than	3	PPM 1
Praseodymium	Less than	0.3	PPM 1
Neodymium	Less than	8	PPM 1
Samarium	Less than	1	PPM 1
Europium	Less than	0.3	PPM 1
Gadolinium	Less than	3	PPM 1
Terbium	Less than	0.8	PPM 1
Dysprosium	Less than	8	PPM 1
Holmium	Less than	0.6	PPM 1
Erbium	Less than	0.6	PPM 1
Ytterbium	Less than	0.6	PPM 1
Tantalum	Less than	6	PPM 1
Tungsten	Less than	0.6	PPM 1
Rhenium	Less than	0.3	PPM 1
Gold	Less than	0.6	PPM 1
Lead	60 PPM	600	PPM
Thorium	Less than	.006	PPM 1
Uranium	Less than	0.6	PPM 1

Internal standard calcium
Assumed concentration = 0.6790E OR%
Dilution factor = 1.0000

1s Interference by complex ions suspected or known 1
All elements from AT. No. 3 - 92 (with exception of C,NA O) looked for conc in PPM and % WT/WT

Unquoted elements were below the detection limit (.01-.1 PPM)

APPENDIX C TABLE XVI

Spark-Source Mass Spectrometric Analysis - Run 9

Regenerator Cyclone Fines (Sampled 13.0000)

Element	Probable Range	
Beryllium	Less than	0 PPM 1
Boron	Less than	0.3 PPM 1
Fluorine	0.3 PPM	3 PPM 1
Sodium	30 PPM	300 PPM 1
Magnesium	0.8 %	8 %
Aluminium	600 PPM	6000 PPM
Silicon	300 PPM	3000 PPM
Phosphorus	6 PPM	60 PPM
Sulphur	0.3%	3 %
Chlorine	30 PPM	300 PPM
Potassium	60 PPM	600 PPM
Scandium	less than	1 PPM 1
Titanium	1 PPM	10 PPM
Vanadium	0.1%	1 %
Chromium	3 PPM	30 PPM
Manganese	30 PPM	300 PPM
Iron	300 PPM	3000 PPM
Cobalt	10 PPM	100 PPM
Nickel	300 PPM	3000 PPM
Copper	6 PPM	60 PPM
Zinc	Less than	100 PPM 1
Gallium	Less than	20 PPM 1
Germanium	Less than	8 PPM 1
Arsenic	80 PPM	800 PPM
Selenium	Less than	2 PPM 1
Bromine	Less than	3 PPM 1
Rubidium	Less than	6 PPM 1
Strontium	800 PPM	8000 PPM
Yttrium	Less than	8 PPM 1
Zirconium	Less than	8 PPM 1
Niobium	Less than	0.8 PPM 1
Molybdenum	3 PPM	30 PPM
Ruthenium	Less than	0.6 PPM 1
Rhodium	Less than	0.6 PPM 1
Palladium	Less than	1 PPM 1

Appendix 6 TABLE XVI
Spark-Source Mass Spectrometric Analysis - Run 9

Regenerator Cyclone Fines (Sampled 13.0000) Contd.

Element	**Probable Range**		
Silver	Less than	0.3	PPM I
Cadmium	Less than	0.5	PPM I
Indium	8 PPM	80	PPM
Tin	Less than	10	PPM I
Antimony	Less than	8	PPM I
Tellurium	Less than	1	PPM I
Iodine	Less than	1	PPM I
Cesium	Less than	0.6	PPM I
Barium	100 PPM	1000	PPM
Lanthanum	0.3 PPM	3	PPM
Cerium	Less than	3	PPM I
Praseodymium	Less than	1	PPM I
Neodymium	Less than	1	PPM I
Samarium	Less than	8	PPM I
Europium	Less than	0.8	PPM I
Gadolinium	Less than	8	PPM I
Terbium	Less than	0.3	PPM I
Dysprosium	Less than	8	PPM I
Holmium	Less than	0.1	PPM I
Tantalum	Less than	3	PPM I
Rhenium	Less than	0.8	PPM I
Lead	30 PPM	300	PPM
Thorium	Less than	0.8	PPM I
Uranium	Less than	0.6	PPM I

Internal standard calcium
Assumed concentration = 0.6700E 00%
Dilution Factor = 1.0000

I= Interference by complex ions suspected or known
all elements from AT. NO. 3 - 92 (with exception of C,H & O) looked for
Conc. in PPM and % WT/WT

Unquoted elements were below the detection limit (.01-.1 PPM)

APPENDIX G TABLE XVI
Spark- Source Mass Spectrometric Analysis - Run 9

Distributor Coarse (Sampled 13.0000)

Element	Probable Range			
Beryllium	Less than	8	PPM	1
Boron	Less than	1	PPM	1
Fluorine	0.3 PPM	3	PPM	
Sodium	60 PPM	600	PPM	
Magnesium	0.2%	2	%	
Aluminium	300 PPM	3000	PPM	
Silicon	0.1 %	1	%	
Phosphorus	5 PPM	60	PPM	
Sulphur	0.6 %	6	%	
Chlorine	30 PPM	300	PPM	
Potassium	80 PPM	800	PPM	
Scandium	Less than	0.3	PPM	1
Titanium	1 PPM	10	PPM	
Vanadium	0.2 %	2	%	
Chromium	Less than	10	PPM	1
Manganese	3 PPM	30	PPM	
Iron	300 PPM	3000	PPM	
Cobalt	3 PPM	30	PPM	
Nickel	100 PPM	1000	PPM	
Copper	0.6 PPM	6	PPM	
Zinc	Less than	30	PPM	1
Gallium	Less than	80	PPM	1
Germanium	Less than	8	PPM	1
Arsenic	1 PPM	10	PPM	1
Selenium	Less than	8	PPM	1
Bromine	Less than	0.3	PPM	1
Rubidium	Less than	0.3	PPM	1
Strontium	0.8 PPM	8	PPM	
Yttrium	Less than	2	PPM	1
Zirconium	Less than	2	PPM	1
Niobium	Less than	0.8	PPM	1
Molybdenum	Less than	10	PPM	1
Ruthenium	Less than	0.2	PPM	1
Rhodium	Less than	0.06	PPM	1
Palladium	Less than	3	PPM	1

APPENDIX G TABLE XVI

Spark-Source Mass Spectrometric Analysis - Run 9.

Elutriator Coarse (Sampled 13.0000) Contd.

Element	**Probable Range**			
Silver	Less than	0.3	PPM	I
Cadmium	Less than	0.3	PPM	I
Indium	Less than	2	PPM	I
Tin	Less than	2	PPM	I
Antimony	Less than	0.6	PPM	I
Tellurium	Less than	2	PPM	I
Cesium	Less than	0.02	PPM	I
Barium	80 PPM	800	PPM	
Lanthanum	0.2 PPM	2	PPM	
Cerium	Less than	3	PPM	I
Praseodymium	Less than	1	PPM	I
Neodymium	Less than	1	PPM	I
Samarium	Less than	0.6	PPM	I
Europium	Less than	0.6	PPM	I
Gadolinium	Less than	2	PPM	I
Terbium	Less than	0.3	PPM	I
Dysprosium	Less than	2	PPM	I
Holmium	Less than	0.1	PPM	I
Erbium	Less than	0.3	PPM	I
Ytterbium	Less than	0.3	PPM	I
Tantalum	Less than	1	PPM	I
Tungsten	Less than	0.3	PPM	I
Rhenium	Less than	0.2	PPM	I
Gold	Less than	1	PPM	I
Lead	Less than	0.6	PPM	I
Thorium	Less than	0.3	PPM	I
Uranium	Less than	0.3	PPM	I

Internal standard   Calcium
Assumed concentration = 0.60% ppm
Dilution factor = 1.0000
I = Interference by complex ions suspected or known - All elements from AT. No. 3 - 92 (with exception of C,N and O) looked for

Conc. in PPM and % WT/WT

Unquoted elements were below the detection limit (.01-.1 PPM)

APPENDIX G. TABLE XVI

Spark- Source Mass Spectrometric Analysis Run 9

Elutriator Fines (sampled 13.0000)

Element	**Probable Range**		
Beryllium	Less than	2	PPM 1
Boron	Less than	0.3	PPM 1
Fluorine	0.1 PPM	1	PPM
Sodium	100 PPM	1000	PPM
Magnesium	300 PPM	3000	PPM
Aluminium	800 PPM	8000	PPM
Silicon	300 PPM	3000	PPM
Phosphorus	6 PPM	60	PPM
Sulphur	0.2 %	2 %	
Chlorine	10 PPM	100	PPM
Potassium	60 PPM	600	PPM
Scandium	Less than	0.3	PPM 1
Titanium	1 PPM	10	PPM
Vanadium	0.08	0.8 %	
Chromium	3 PPM	30	PPM
Manganese	3 PPM	30	PPM
Iron	100 PPM	1000	PPM
Cobalt	3 PPM	30	PPM
Nickel	30 PPM	300	PPM
Copper	8 PPM	80	PPM
Zinc	Less than	20	PPM 1
Gallium	8 PPM	80	PPM
Germanium	Less than	2	PPM 1
Arsenic	0.3 PPM	3	PPM
Selenium	Less than	6	PPM 1
Bromine	Less than	0.3	PPM 1
Rubidium	Less than	0.3	PPM 1
Strontium	60 PPM	600	PPM
Yttrium	Less than	2	PPM 1
Zirconium	Less than	2	PPM 1
Niobium	Less than	0.2	PPM 1
Molybdenum	1 PPM	10	PPM 1
Ruthenium	Less than	0.2	PPM 1
Rhodium	Less than	0.05	PPM 1
Palladium	Less than	1	PPM 1

APPENDIX G TABLE XVI

Spark Source Mass Spectrometric Analysis - Run 9

[illegible] (Sampled 13.0000) contd.

Element	Probable Range			
Silver	Less than	1	PPM	I
Cadmium	Less than	0.3	PPM	I
Indium	Less than	0.3	PPM	I
Tin	0.6 PPM	6	PPM	
Antimony	0.8 PPM	8	PPM	
Tellurium	Less than	0.6	PPM	I
Iodine	Less than	0.6	PPM	I
Cesium	Less than	0.06	PPM	I
Barium	Less than	0.06	PPM	I
Lanthanum	80 PPM	800	PPM	
Cerium	0.1 PPM	1	PPM	
Praseodymium	Less than	1	PPM	I
Neodymium	Less than	0.3	PPM	I
Terbium	Less than	1	PPM	I
Dysprosium	Less than	0.1	PPM	I
Hafnium	Less than	0.6	PPM	I
Tantalum	Less than	0.3	PPM	I
Tungsten	Less than	1	PPM	I
Rhenium	Less than	0.8	PPM	I
Gold	Less than	0.1	PPM	I
Lead	0.8 PPM	8	PPM	
Thorium	Less than	0.1	PPM	I
Uranium	Less than	0.8	PPM	I

Internal standard calcium
Assumed concentration = 0.6000 PPM
Dilution factor = 1.0000

I = Interference by complex ions suspected or known. - All elements from AT. No. 3 - 92 (with exception of C,N & O) looked for - Conc. in PPM and # WT/WT - Unquoted elements were below the detection limit (.01-.1 PPM)

CAFB [illegible]

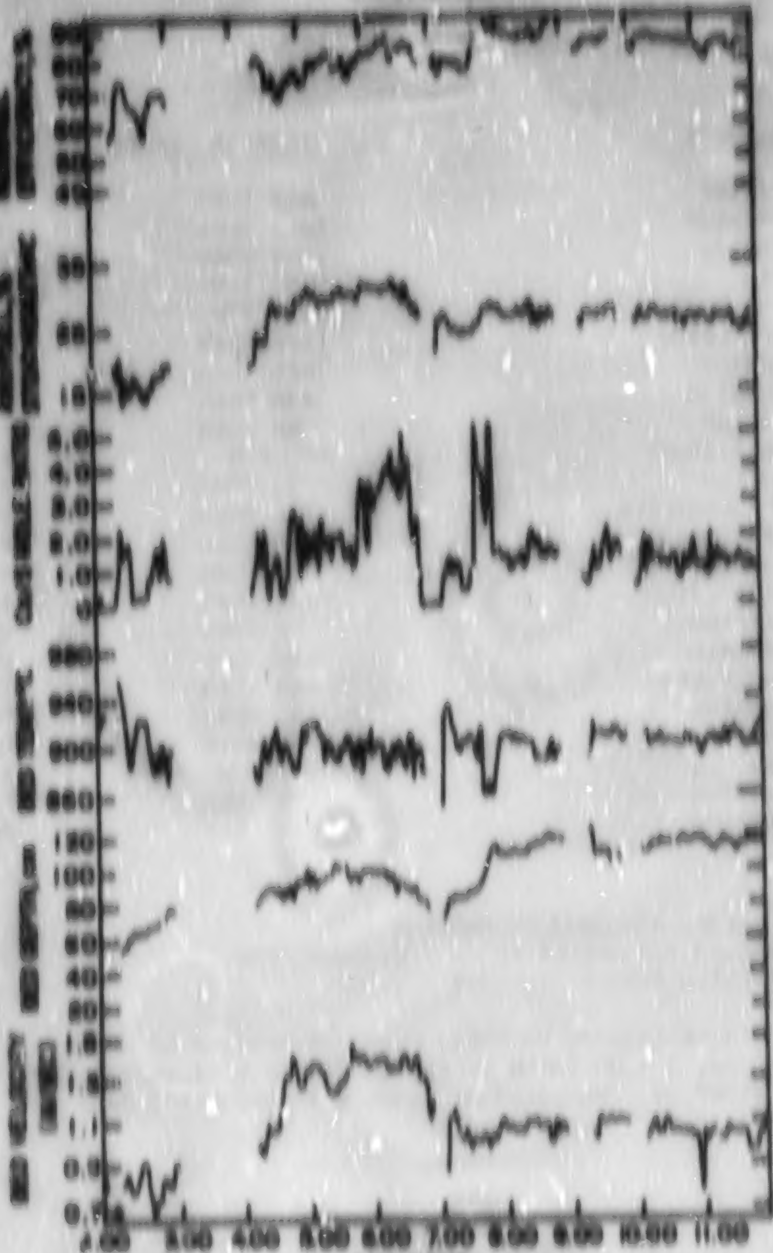

FIG. 6-23.

DAFB RUN 9 (cont'd)

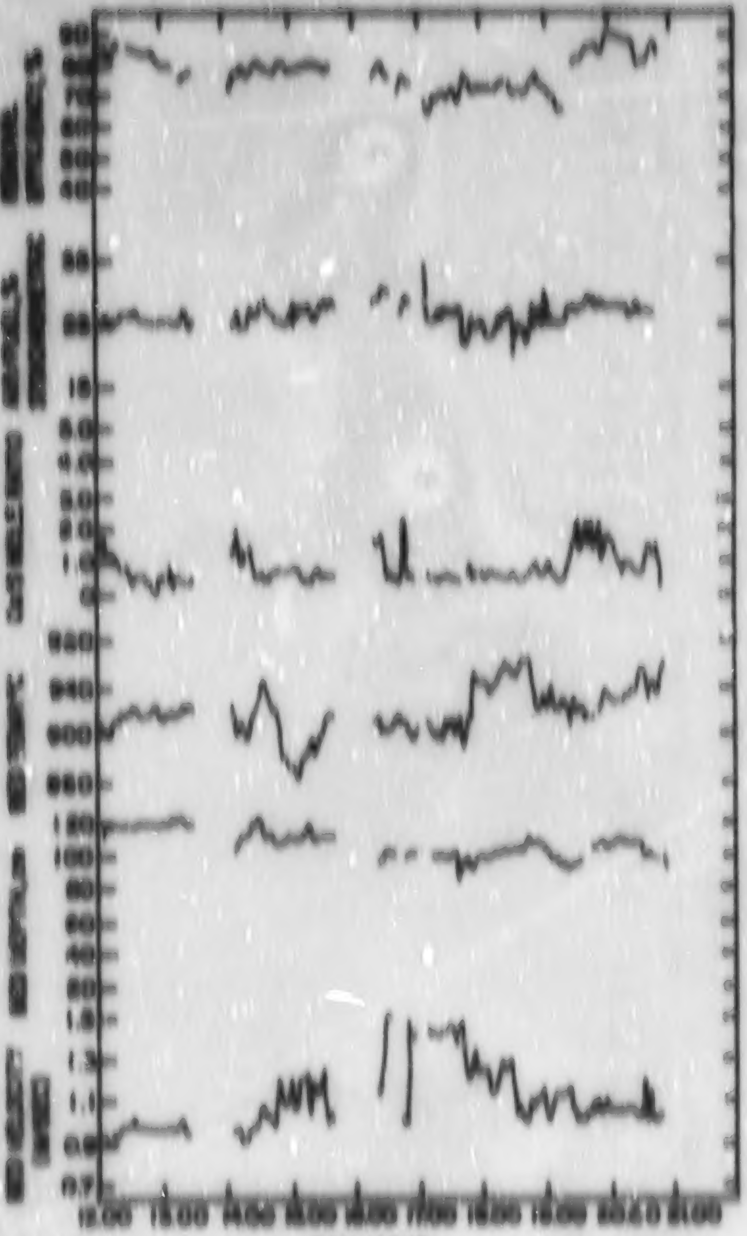

FIG. 6-23(cont.)

[illegible] (cont)

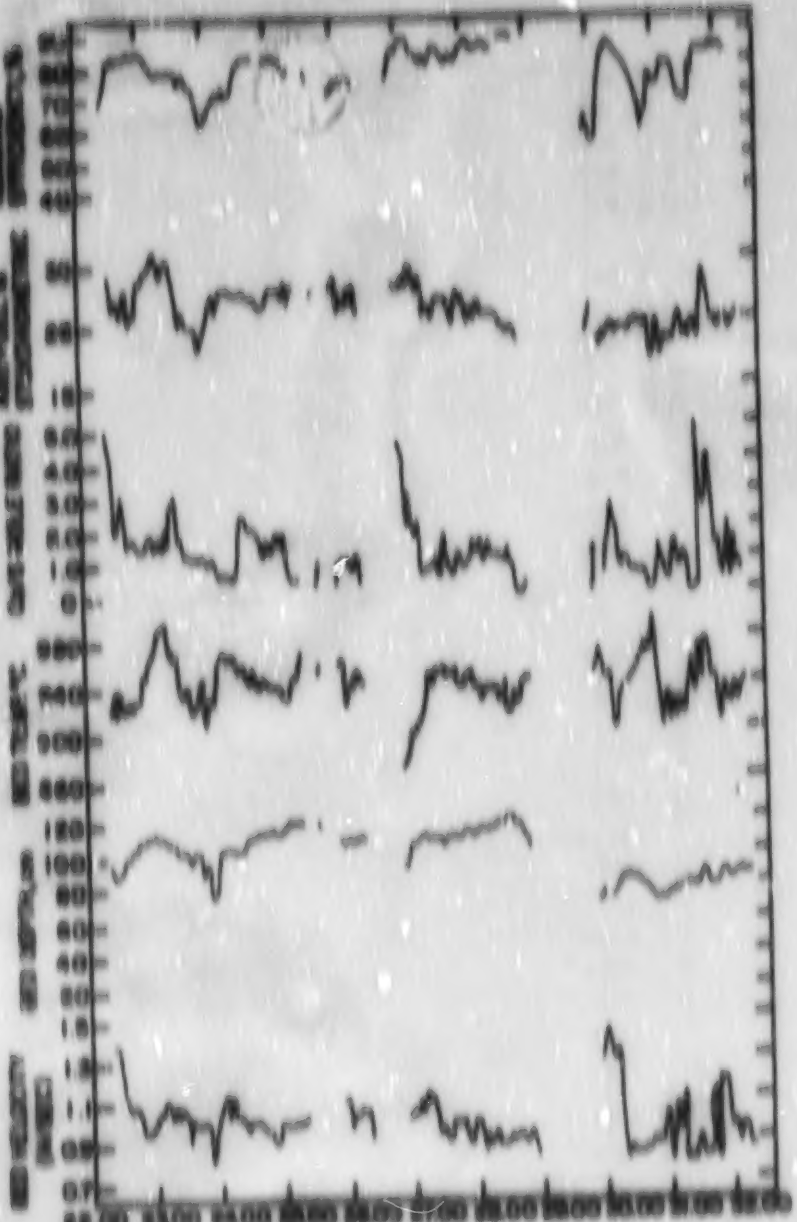

FIG. 6-23(cont)

GASIFIER TOP SPACE PRESSURE RUN 9

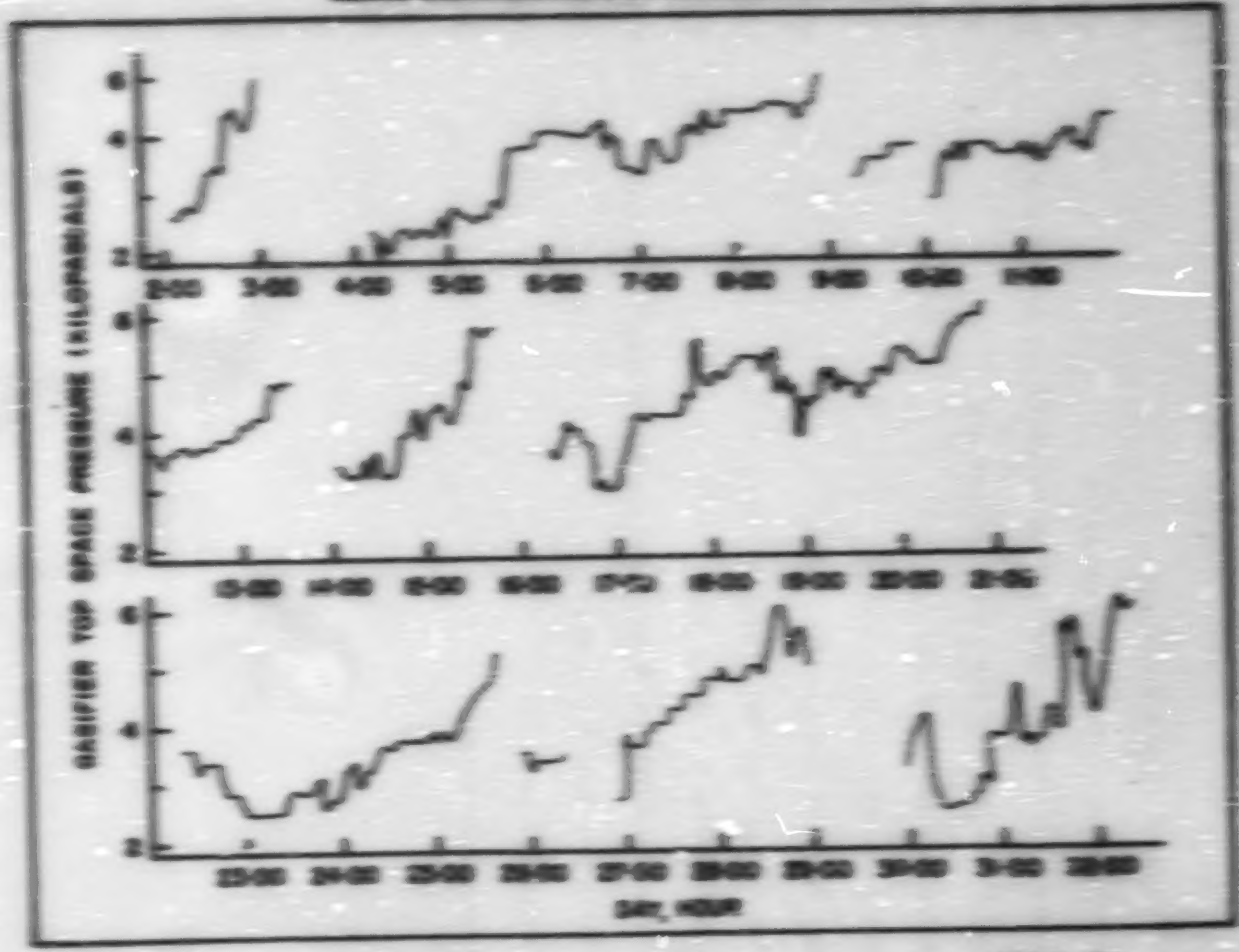

FIG.6-24.

APPENDIX H

Programmes and Methods of Analyses of Continuous Run Data

Page

Stepwise Multiple Regression 533
Limitations of Multiple Regression 533
Regression Analysis Correlation Matrices for Runs 8 & 9 534
Bed Depth and Cyclone Drain Temperature 534
Bed Depth and Bed Fines 535
Bed Velocity and Added Water 536
Bed Velocity and Air/Fuel Ratio 536
Bed Sulphur and Bed Temperature/Bed Depth 536
Bed Velocity and Bed Depth 536
Correlation Between % [illegible] and Several Process Variables 537
Editing of Runs 8 & 9 Data 537
Tables H-I to H-III 539
Computer Programmes 542

APPENDIX H

METHOD OF ANALYSIS OF CONTINUOUS RUNS 8 AND 9

Stepwise Multiple Regression

Stepwise multiple regression analysis of the data was carried out using a standard programme 'Mul-Correlation' available on the Honeywell HK 111 Foreground system. This programme produces linear equations of the form:-

$$y = b_o + b_1X_1 + b_2X_2 + \cdots b_mX_m + e$$

where y is the dependent variable

$X_1, \cdots X_m$ are the independent variables

$b_o, \cdots b_m$ are the regression coefficients to be determined

e is a random error term which gives the difference between the predicted and actual for the dependent variable

In this stepwise regression routine, the basic premise which distinguishes it from conventional approaches to multiple regression is that intermediate partial regression equations are developed to indicate whether a variable is significant in any early stage of the regression calculation so that it may be entered into the regression at that stage. The final regression equation should, therefore, only contain significant variables. The programme allows the user to specify the level of significance such that the independent variable is entered or removed from the regression equation during the analysis. However, it is possible to override this mechanism and force a variable into the regression equation despite the fact that it may not meet the specified significance level criteria. This is obviously useful when the variable is known to be significant from other sources.

Limitations of Multiple Regression

Although multiple regression analysis, including stepwise, is an extremely powerful tool, it is subject to certain limitations which the user should be aware of in order not to be led astray.

Perhaps the most important point to remember is that it is not possible to infer cause and effect relationships from regression analysis. The fact that a dependent variable is highly correlated with an independent variable in no way suggests that a change in the independent variable causes a change in the dependent variable. Although such relationships may exist they cannot be proved. We can say that the results do not refute the theory, but neither do they prove it.

A second important point is that regression relationships are empirical equations that apply only to the range of data on which they are based. Extrapolation can lead to highly erroneous results. Since regression equations are based on the experimental data, then the equation is no more accurate than the data. If the data is subject to large experimental error, the regression equation will predict inaccurately.

An underlying assumption in regression analysis is that the independent variables are truly independent, and that there are no interactions between variables. In practice great skill in experimental design is needed to achieve this end and sometimes in complex processes, such as this one, it is only possible to a limited extent.

A final important point to remember is that regression analysis assumes linear relationships between the dependent variables and the independent variable. In order to deal with variables which are obviously non-linear, it is necessary to transform the variable into some algebraic function of itself before carrying out the regression. A measure of the non-linearity of the variable is the improvement in the '% explained' of the resultant regression equation over the linear version.

Regression Analysis Correlation Matrices for Runs 8 and 9

Another feature of the regression programme 'Mul-Correlation' is the print out of the correlation matrix. This provides on a one to one basis the degree of correlation between the dependent variable and each of the independent variables in turn, and also how each independent variable correlates with the others. This is particularly useful in identifying which of the variables are truly independent.

A negative correlation matrix number indicates that during the test when one variable increased in general the other decreased. A useful measure of the intercorrelation of the various variables is obtained by taking the square of the correlation matrix number and multiplying by 100 to give the '% explained' of one variable by another. Thus a correlation matrix number of one or minus one gives '100% explained', and means that for the purposes of the test the variables are indistinguishable. A value of zero means the variables are truly independent of each other. A value of 0.5 means 25% of the variance of one variable is reflected by the other.

Table H-I and H-II contain the correlation matrices for the variables that have been considered in this analysis. A considerable amount of useful information is contained in both tables, but it is sufficient at the moment to indicate a few key points. The correlation matrix numbers of the variables with respect to % SRE will be considered later in more detail, but for the moment let us concentrate on the dependent variables. Particularly important in this respect are variables with a high degree of inter-correlation, and for the purposes of this analysis we shall define this as having a correlation matrix number (either positive or negative) greater that or equal to 0.5. The values falling into this category are highlighted in Tables H-I and H-II.

Bed Depth and Cyclone Drain Temperature

The cyclone drain temperature is a measure of the amount of fines circulating from the bed to the cyclones, and hence it is not unexpected that the deeper the bed the more fines should circulate. What is interesting is that this correlation is more pronounced in Run 8 than in Run 9. After Run 8 the gasifier was modified to expand the free board space above the bed, and reduce the possibility of fines circulation. The drop in the correlation of these two variables in Run 9 reflects this design change.

Bed Depth and Bed Fines

The correlation matrix for Run 9 shows a surprisingly high correlation between bed fines in the range $(600-250\mu)$, and bed depth, whereas in Run 8 the correlation is low. At the start of Run 9 unsieved limestone was fed to the gasifier to increase the bed depth. However, after several unsuccessful attempts to increase the bed depth to high levels using unsieved limestone, coarser material was used. Thus as a direct result of how the experiment was conducted during Run 9, a fortuitous correlation was established between these two variables which was not present in Run 8.

Bed Velocity and Added Water

The correlation between bed velocity and added water is an important one, and has caused considerable difficulty in the analysis of the data. The fuel used in Run 9 was free from water contamination, and as a consequence the only way water was introduced was via flue gas recycle. Unfortunately in the majority of cases, when high bed velocities were evaluated this was carried out by operating at high flue gas recycle levels, and hence the correlation was established. Fortunately in Run 8, water was also introduced from two other sources, namely water in the fuel and steam injection, and this has lowered the correlation between these two variables. Since water in Run 8 has been shown to be detrimental to % SRE, it has been assumed that water and not bed velocity is the detrimental factor in Run 9.

Bed Velocity and Air/Fuel Ratio

A fair degree of correlation exists between bed velocity and air/fuel ratio, both in Run 8 and Run 9. This probably relates to the fact that to operate lean and at a reasonable bed temperature some cooling with flue gas recycle was necessary.

Bed Sulphur and Bed Temperature/Bed Depth

Bed sulphur in Run 8 correlates somewhat with bed temperature and bed depth. Fortunately in Run 9 this correlation does not exist indicating it may be somewhat fortuitous.

Bed Velocity and Bed Depth

In Run 8 there was a high negative correlation between bed velocity and bed depth. Fortunately this is not reflected in Run 9, and the correlation appears to be fortuitous.

The above discussion illustrates some of the problems of regression analysis, and clearly shows the value of looking at both runs together.

Correlation Between % SRE and Several Process Variables

Table H-III compares the correlation matrix number with respect to % SRE for Runs 8 and 9. Several interesting points are highlighted in this table:-

(a) The best single predictor of % SRE in Run 8 was 'added water' due to the high levels introduced by water contamination of the fuel. In Run 9 bed depth followed closely by cyclone drain temperature was the best single predictor.

(b) The matrix numbers for air/fuel ratio, Ca/S mole feed ratio and bed velocity are comparable in direction and magnitude in both runs.

(c) Those for bed carbon, bed sulphur and bed temperature conflict between the two runs, whereas bed fines shows no correlation with % SRE.

The importance of looking at the data as a whole is again borne out in Table H-III. For example, analysis of Run 9 in isolation could well have resulted in regression equations incorporating bed sulphur as a significant variable, which detrimentally affected % SRE. In fact there is some supporting evidence from earlier runs on this subject. However, the data from Run 8 conflicts with this observation (see Figure 35).

Although on a one to one basis with % SRE, the data for bed temperature is conflicting, in actual practice when the effect of other variables were included in the multiple regression equation this variable gave a consistent negative correlation coefficient for both runs. (See Table H-II).

Editing of Runs 8 and 9 Data

An important aspect of the analysis method was to try to use, as far as possible, all the data generated throughout the runs. During the course of the analysis, however, it became clear that some editing of the data was necessary. In this respect the graphical displays of residual errors from the regression equations were invaluable.

In order to improve the accuracy of the data some modification of the hourly readings recorded in Appendices F & G tables was necessary to take account of the method of retrieval. Flue gas SO_2 levels for example were recorded continuously throughout the runs and the values listed in Table 5, Appendices F & G, refer to the average value for the previous hour, whereas other process variables, such as bed depth for example were recorded only at the end of the hourly period. This is entirely satisfactory if conditions remain constant throughout the hourly period, but is less so if the conditions are changed during the hour whether deliberately or not. To account for this the mean of the process readings at the beginning and the end of the hourly period was taken as the value for that hour. This was only done with key variables which might be incorporated in the regression equation, and the computer programme written to perform this task is listed at the end of this Appendix.

During the course of the analysis some of the data was rejected but not before a satisfactory reason was generated for doing so. Data was omitted for the following reasons:-

- Incomplete data particularly if for one reason or another the % sulphur removal efficiency reading was unavailable or a key process variable, e.g. bed depth was unrecorded.
- Initial first or second hours operation after a shutdown particularly after sulphation. The readings of sulphur removal efficiency were generally low compared with the predicted value, presumably due to the fact that some regeneration of the sulphated lime to produce SO_2 was taking place.
- Two periods in Run 9 when Aragonite limestone was used instead of WCR 1359 resulted in predicted values lower than experimentally observed. It was decided to eliminate this data from the initial analysis and treat these results separately.

TABLE [illegible]

REGRESSION ANALYSIS CORRELATION MATRIX - [illegible]

Variable	% [illegible]	Bed Carbon (wt.%)	Bed Velocity (m/sec)	Bed Temp. (°C)	Air/ Fuel Ratio	Cyclone Drain Temp. (°C)	Bed Sulphur (wt.%)	Water Added (m³/hr)	Ca/S Mole Ratio	Bed Fines (500-250μ)	Bed Depth (cm)
% [illegible]	1.0	0.2	-0.2	0.1	0.4	0.3	0.4	$\boxed{-0.9}$	0.3	0.2	$\boxed{0.5}$
Bed Carbon (wt.%)		1.0	-0.2	0.2	-0.2	0.1	-	-0.3	-	-0.1	0.3
Bed Velocity (m/sec)			1.0	-0.1	$\boxed{0.5}$	-0.1	-	0.4	-	-0.1	$\boxed{-0.5}$
Bed Temperature (°C)				1.0	0.1	0.1	$\boxed{0.5}$	-0.3	-0.3	-0.1	0.3
Air/Fuel Ratio					1.0	0.3	-0.1	-0.2	0.3	0.3	0.1
Cyclone drain Temperature (°C)						1.0	-	-0.2	0.0	0.2	$\boxed{0.7}$
Bed Sulphur (wt.%)							1.0	-0.4	-0.1	-	$\boxed{0.5}$
Water added* (m³/hr)								1.0	-0.1	0.0	-0.4
Ca/S Mole Ratio									1.0	0.0	0.0
Bed Fines (500-250μ)										1.0	0.1
Bed Depth (cm)											1.0

* The square of this variable was used in the regression analysis.

TABLE [illegible]

[illegible] - [illegible] 9

Variable	% SRE	Bed Carbon (wt.%)	Bed Velocity (m/sec)	Bed Temp. (°C)	Air/ Fuel Ratio	Cyclone Drain Temp. (°C)	Bed Sulphur (wt.%)	Water Added (m^3/hr)	Ca/S MOLE Ratio	Bed Fines (600-25µ)	Bed Depth (cm)
% SRE	1.0	-0.2	-0.2	-0.2	0.3	$\boxed{0.6}$	-0.4	-0.3	0.3	0.0	$\boxed{0.6}$
Bed Carbon (wt.%)		1.0	-0.2	0.1	-0.1	-0.2	0.1	-0.2	-	-0.2	0.0
Bed Velocity (m/sec)			1.0	-0.3	0.4	0.2	0.1	$\boxed{0.8}$	0.2	0.0	-0.1
Bed Temperature (°C)				1.0	0.2	-0.2	0.0	-0.3	-0.2	-0.2	0.0
Air/Fuel Ratio					1.0	0.3	-0.2	0.2	0.3	-0.2	0.4
Cyclone drain Temperature (°C)						1.0	-	0.1	0.3	0.1	0.4
Bed Sulphur (wt.%)							1.0	-	-0.2	-	-0.3
Water added* (m^3/hr)								1.0	0.1	-	-0.2
Ca/S Mole Ratio									1.0	-	-0.1
Bed Fines (600-25µ)										1.0	$\boxed{-0.6}$
Bed Depth (cm)											1.0

* The square of this variable was used in the regression analysis.

TABLE II-III

COMPARISON OF CORRELATION MATRIX NUMBERS WITH RESPECT TO % SR FOR RUNS 8 AND 9

Variable	Run 8 Correlation Numbers With % SR	Run 9 Correlation Numbers With % SR
Bed depth (cm)	0.49	0.61
*Added Water (m^3/hr)	-0.07	-0.25
Cyclone Temperatures (°C)	0.31	0.56
Bed Temperature (°C)	0.13	-0.19
Air/Fuel Ratio	0.35	0.34
Ca/S Mole Ratio	0.27	0.27
Bed Carbon (wt.%)	0.16	-0.16
Bed Velocity (m/sec)	-0.01	-0.19
Bed Sulphur (wt.%)	0.30	-0.42
% Bed Fines (600-250μ)	-0.003	-0.01

* square of variable.

COMPUTER PROGRAMMES FOR DATA ANALYSIS

GRAFPLOT

```
100 DIMENSION VAR(150)
110 INTEGER MHRS(150)
120 FILENAME FN
130 20 PRINT ," WHICH FILE";INPUT,FN
140 J=1
150 READ(FN,150)TIM,VAR(1);150 FORMAT(V)
153 FIRS=100.*AMOD(TIM,1.)
154 LOOK=FIRS
160 IF(LOOK-12)31,32,33
163 32 LOOK=0;GOTO31
166 33 LOOK=LOOK-12
168 31 LOOK=12-LOOK
170 TIM1=24.*AINT(TIM)+FIRS
175 MHRS(1)=1;BIG=VAR(1);SMAL=BIG
180 2 J=J+1
190 30 READ(FN,150,END=1) TIM,VAR(J)
194 IF(VAR(J))30,21,21
200 21 TIM=24.*AINT(TIM)+100.*AMOD(TIM,1.)
210 MHRS(J)=1.5+TIM-TIM1
220 IF(VAR(J)-BIG)4,4,3
230 3 BIG=VAR(J);GO TO 2
240 4 IF(SMAL-VAR(J))2,2,5
250 5 SMAL=VAR(J);GO TO 2
260 1 J=J-1
265 K=MHRS(J)-1
270 PRINT,J,"  VALUES IN",K,"  HRS"
280 PRINT,"VARIABLE RANGES FROM ",SMAL,"TO",BIG
290 PRINT,"AT WHAT VALUES DO YOU WANT AXIS MARKINGS -FIRST&STEP"
300 INPUT,FIRS,STEP
310 PCE=(BIG-SMAL)/110.
320 PRINT,"0";PRINT 100;PRINT,"     "
```

GRAFPLOT (Cont'd.)

```
330 PRINT 101
340 101 FORMAT (1H1,30X,/,1H )
350 LHTX=0
360  11 IF(FIRS-BIG)7,7,6
380 100 FORMAT(1H+)
390 7 LHT=0.5+(FIRS-SMAL)/PCE
400 LCH=LHT-LHTX
410 10 IF(LCH)8,8,9
420 9 PRINT 103
430 103 FORMAT(2H8 )
440 LCH=LCH-1;GO TO 10
450 8 PRINT 107
455 107 FORMAT(2H8)
460 LHTX=LHT+1; FIRS=FIRS+STEP;GO TO 11
470 6 LINE=1;NCOL=0;PRINT 100
475 LCH=0
480 DO 95 K=1,J
490 15 IF(NNRS(K)-LINE)12,12,14
500 14 LINE=LINE+1;LCH=LCH+1;PRINT 104;IF(LCH-LOCK)15,35,15
510 104 FORMAT(1H8,"
                      ")
514 35 PRINT 100;PRINT 110;NCOL=0;LCH=LOCK-12;110 FORMAT(2H+-)
516 GOTO15
520 12 LHT=0.5+(VAR(K)-SMAL)/PCE
530 10 IF(LHT-NCOL)13,16,17
540 13 NCOL=NCOL-1;PRINT 105;GO TO 15
550 17 NCOL=NCOL+1; PRINT105;GO TO 10
560 105 FORMAT(1H8,"")
570 16 NCOL=LHT+1;PRINT 106
580 106 FORMAT(2H8.)
590 95 CONTINUE
600 PRINT 101 ;GO TO 80
610 STOP;END
```

BLEDIT

```
50! THIS PROGRAMME UNIFIES THE HOURLY READINGS SELECTED FROM
60! FILES JI40(DAILY DATA BANK-RUN 9),TCYC9(CYCLONE TEMPERATURES)
70! DLARDF9(RED FIVES) AND FILES IN GRGRES9
100 FILELIST "JI40","GRGRES9","TCYC9","DLARDF9"
110 DIMENSION A(95),G(3),C(9),D(4)
112 J=0
115 READ(1)A
120 120 READ(1,END=1000)A
121 READ(3,1000)G;1000 FORMAT(V)
123 READ(4,1000)D
130 130 TI=INT(A(1))
131 TI4=INT(100.*(A(1)-TI)+0.001)
132 JI4=24.*TI+TI4+(A(1)-TI-0.01*TI4)*1000./6
140 IF(J)200,200,150
150 150 IF((JI4-JI).EQ.-1)GO TO 240
200 200 XS=0.;YS=0.;ZS=0.;DS=0.;HS=0.;TS=0.
205 205 REDD=A(4)+(XS/9);REDV=A(24)+(YS/9)
206 REDT=A(6)+(ZS/9);APR=A(31)+(DS/9);G(3)=A(95)+(TS/9)
207 S=INT(100.*A(7A))
208 SHE=A(93)-(S/(S1-A(10)))
210 WRITE(2,212)A(1),SHE,A(89),REDD,REDV,REDT,APR,G(3),D(3),S,A(11)
212 212 FORMAT(1X,F9.4,F6.1,F6.3,F6.0,F6.2,F6.0,F6.1,F6.3,3F6.1)
220 J=1;JI=JI4;XA=A(4);YA=A(24);ZA=A(6);DA=A(31);HA=A(10);TA=A(95)
230 GO TO 120
240 240 XS=XA-A(4);YS=YA-A(24);ZS=ZA-A(6);DS=DA-A(31);HS=HA-A(10)
245 TA=A(95)
250 GO TO 205
260 1000 STOP;END
```

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[illegible]

```
50C THIS PROGRAMME TESTS THE NON LINEARITY OF VARIABLE
 AND AIR/FUEL RATIO AND GROUPS THE DATA INTO BOXES
100 FILELIST"GRAD19","RESDS"
110 DIMENSION A(15),RED(11),AVRD(11),RESD(11,400),SET(11,400)
111&,SUM(11),TOT(11),TEAV(11),TED(11,400)
115 TALLY=0.
120 DO 140 I=1,11$ DO 135 J=1,400
130 RESD(I,J)=0.$SET(I,J)=0.
135 135 CONTINUE
140 140 CONTINUE
145 L=1
150 150 READ(1,151,END=300)A$151 FORMAT(V)
160 X=0.1474*A(4)-0.0355*A(6)+0.944*A(7)
170 Y=0.0045*A(4)-0.0105*(A(10)**2)+1.94*A(11)
180 R=A(3)-(X-Y),45
200 TALLY=TALLY+(R*R)
210 DO 260 I=10,40,3
220 T=I
230 DIF=A(7)-T
240 IF(DIF.GE.3..OR.DIF.LT.0.)GO TO 260
250 IAG=INT(((T-10.)/3.)+1.)
255 RESD(IAG,L)=R*0.944*A(7)
256 SET(IAG,L)=1.
257 TED(IAG,L)=A(7)
258 GO TO 270
260 260 CONTINUE
270 270 L=L+1$GO TO 150
300 300 KAT=L-1
305 DO 310 I=1,11
306 SUM(I)=0.$TOT(I)=0.$TEAV(I)=0.
307 AVRD(I)=0.
310 310 CONTINUE
320 DO 350 I=1,11
330 DO 340 J=1,KAT
331 SUM(I)=SUM(I)+RESD(I,J)$TOT(I)=TOT(I)+SET(I,J)
334 AVRD(I)=AVRD(I)+TED(I,J)
340 340 CONTINUE
350 350 CONTINUE
360 SE=SQRT(TALLY/(KAT-1))
370 DO 390 I=1,11
375 IF(SUM(I).EQ.0.)GO TO 390
380 TEAV(I)=SUM(I)/TOT(I)
381 RED(I)=AVRD(I)/TOT(I)
390 390 CONTINUE
400 WRITE(6,410)SE,TEAV,TOT,RED
4100 $
410 410 FORMAT(1X,10H0RSE= ,F6.3/6X6HTEAV= ,
415&11F6.3/6X5HTOT= ,11F6.0/6X5HRED= ,11F6.1)
420 STOP$END
```

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APPENDIX I

CAFB PILOT PLANT DESCRIPTION AND OPERATING PROCEDURES

CONTENTS

Page No.

I. CAFB PILOT PLANT

Introduction 549
Flow Plan and Layout 549
Process Control 549
Gasifier-Regenerator Unit 550
The Stone Handling System 554
Main Burner Description 554
Analytical Sampling and Instrumentation 554
Boiler and Pressurization System 558
Safety Alarm Systems 558

FIGURES

Figure I-1 550
Figure I-2 551
Figure I-3 552
Figure I-4 553
Figure I-5 556
Figure I-6 557

II. OPERATING PROCEDURES

Safety 564
Fuel and H_2 Supply Prerun Checks 565
Boiler and Systems Prerun Checks 566
Gasifier Prerun Checks 566
Gasifier Warm Up 567
Preheat Burner Light Up 568
Preheat Burner Flame Out 570
Heavy Fuel Oil Pump Calibration 570
Change from Propane to Kerosene 570
Starting Stone Feed 571
Boiler Clean Out 572

CONTENTS (continued)

	Page No.
Start Main Flame Pilot Light	574
(a) Main Flame Out	
(b) Main Flame On	575
Change from Kerosene Combustion to Fuel Oil Combustion	575
Change over from Combustion to Gasification	577
On Gasification	577
Trouble-Shooting on Steady State Conditions	581
Planned Shutdown on Gasification	581
(a) With Sulphation	583
(b) Without Sulphation	583
Emergency Shutdown	584
Carbon Burn Out	586
Completion of Carbon Burn Out	
Restart after Shutdown	586
(a) From Sulphated Bed after Carbon Burn Out	587
(b) From Sulphided Bed after Carbon Burn Out	588
(c) From Sulphided Bed without Carbon Burn Out	589
Sampling of Hot Bed Material	589
Rodding Out	589
Injection of Toxic Gases	590
Preventive Maintenance and Sampling during Run	

I. CAFB PILOT PLANT

INTRODUCTION

A continuous CAFB gasifier pilot plant has been constructed at the Esso Research Centre to provide a demonstration of the CAFB process under continuous operating conditions and to provide a means for studying those operational variables which cannot be measured in batch reactors. Features of the pilot plant are summarised here.

FLOW PLAN AND LAYOUT

Figure I-1 is a process flow plan of the continuous pilot plant. The heart of the system is the gasifier-regenerator unit cast of refractory concrete contained in an internally insulated steel shell. The product gas of the gasifier fires a 10 million Btu/hr pressurised water boiler. The hot water is heat exchanged with a secondary water circuit which loses its heat through a forced convection cooling tower. The rest of the system consists of the necessary blowers, pumps and instruments to operate the gasifier, regenerator, burner and solids circulating system.

Figure I-2 shows the layout of the pilot plant equipment within its building. The gasifier itself sits within a pit to permit alignment of the gasifier outlet duct with the burner inlet. Fuel pumps, flow meters, and start up burner controls are mounted on a mechanical equipment console in the control room. Electrical instrumentation and manometers are mounted in a separate control cabinet in the control room. Gasifier blowers are located in a separate blower house outside the main building, and the cooling tower is mounted on the roof.

PROCESS CONTROL

Figure I-3 is a diagram of the pilot plant instrumentation system. Automatic control boxes are used to regulate regenerator temperature and regenerator bed level, and gasifier bed level. A packaged pressurisation system maintains constant boiler cooling water pressure and temperature. All other systems are manually controlled by the process operator. Dashed lines in Figure I-3 show the indicators and control valves normally used by the operator. Manometers indicate pressures and pressure differences in most applications. In four instances pressure differences are also detected by pneumatic delta pressure cells and transmitted to recorders. Pressure switches also are employed in several locations to operate warning lights for abnormal conditions.

CAFB PILOT PLANT FLOW PLAN

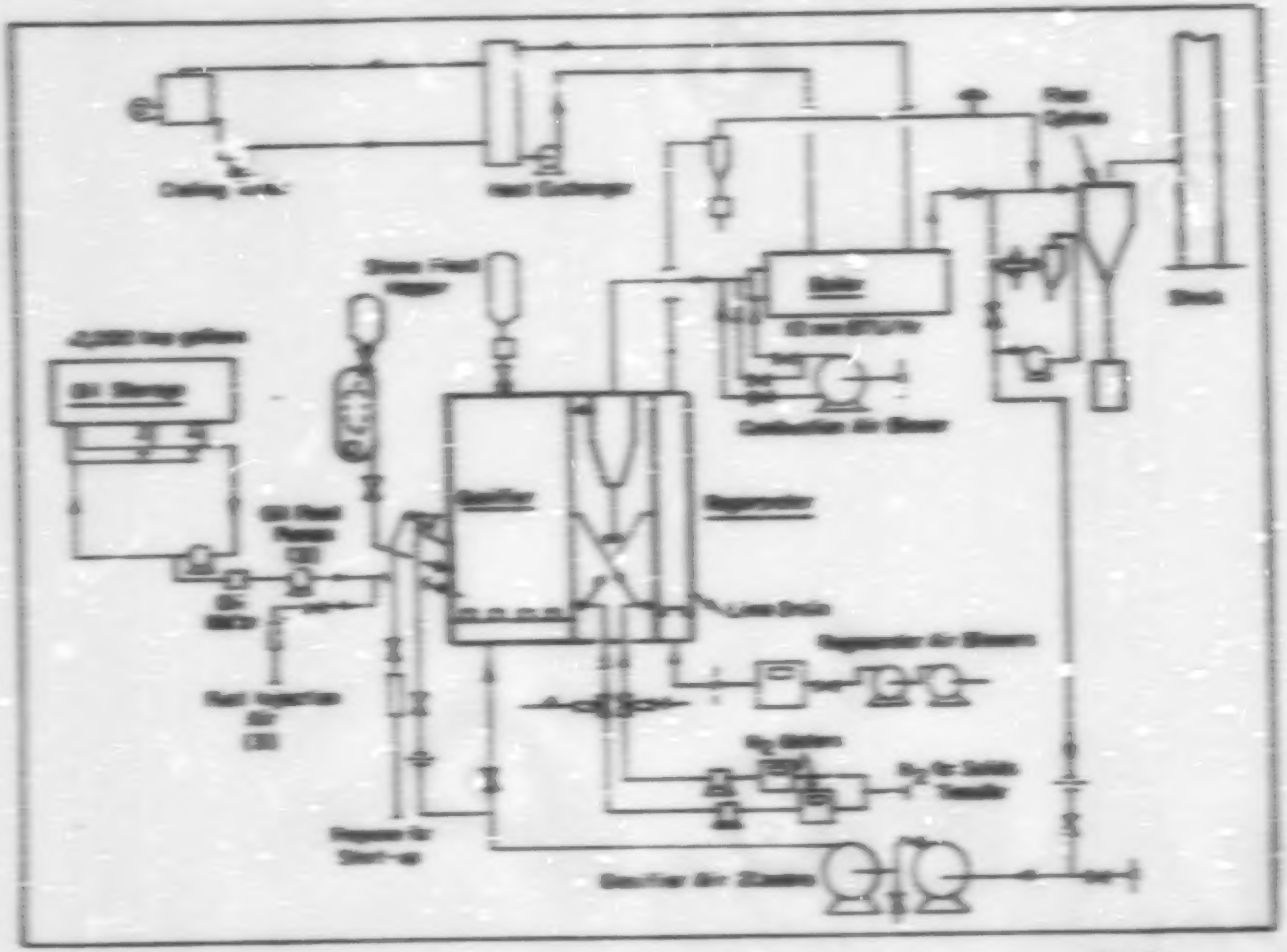
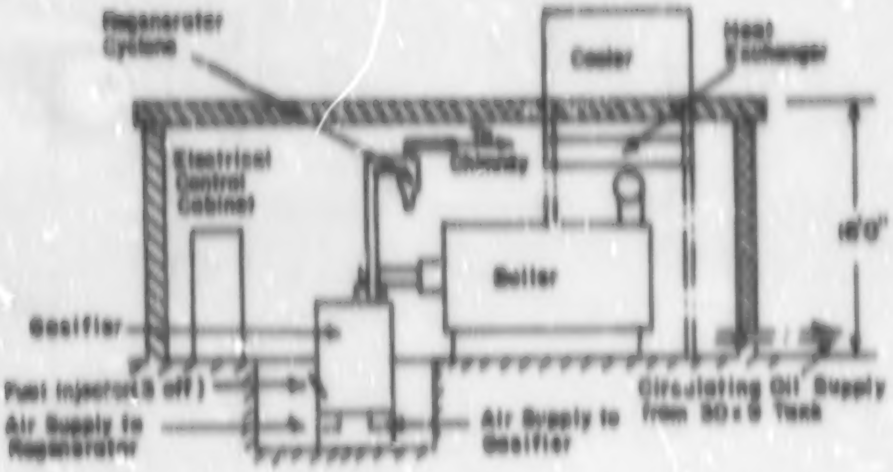
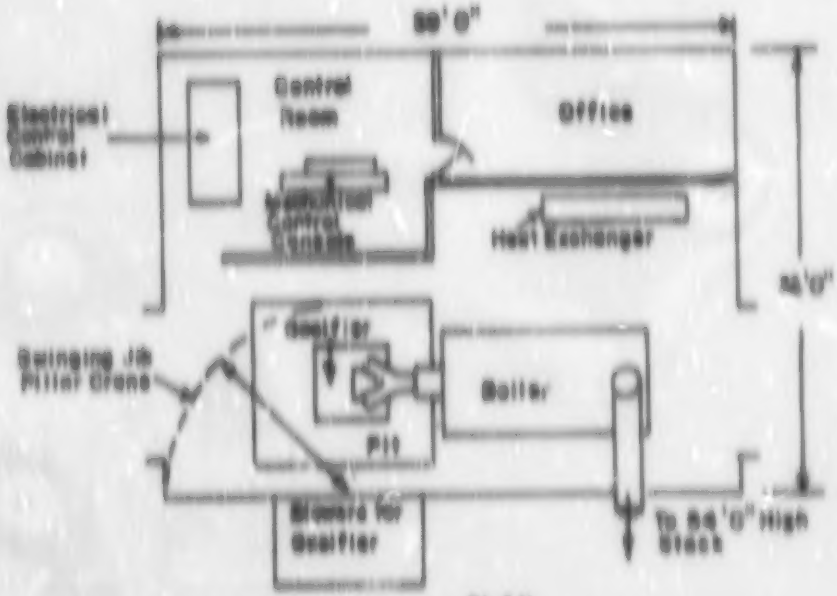


FIG.I-1.

GENERAL PLANT LAYOUT



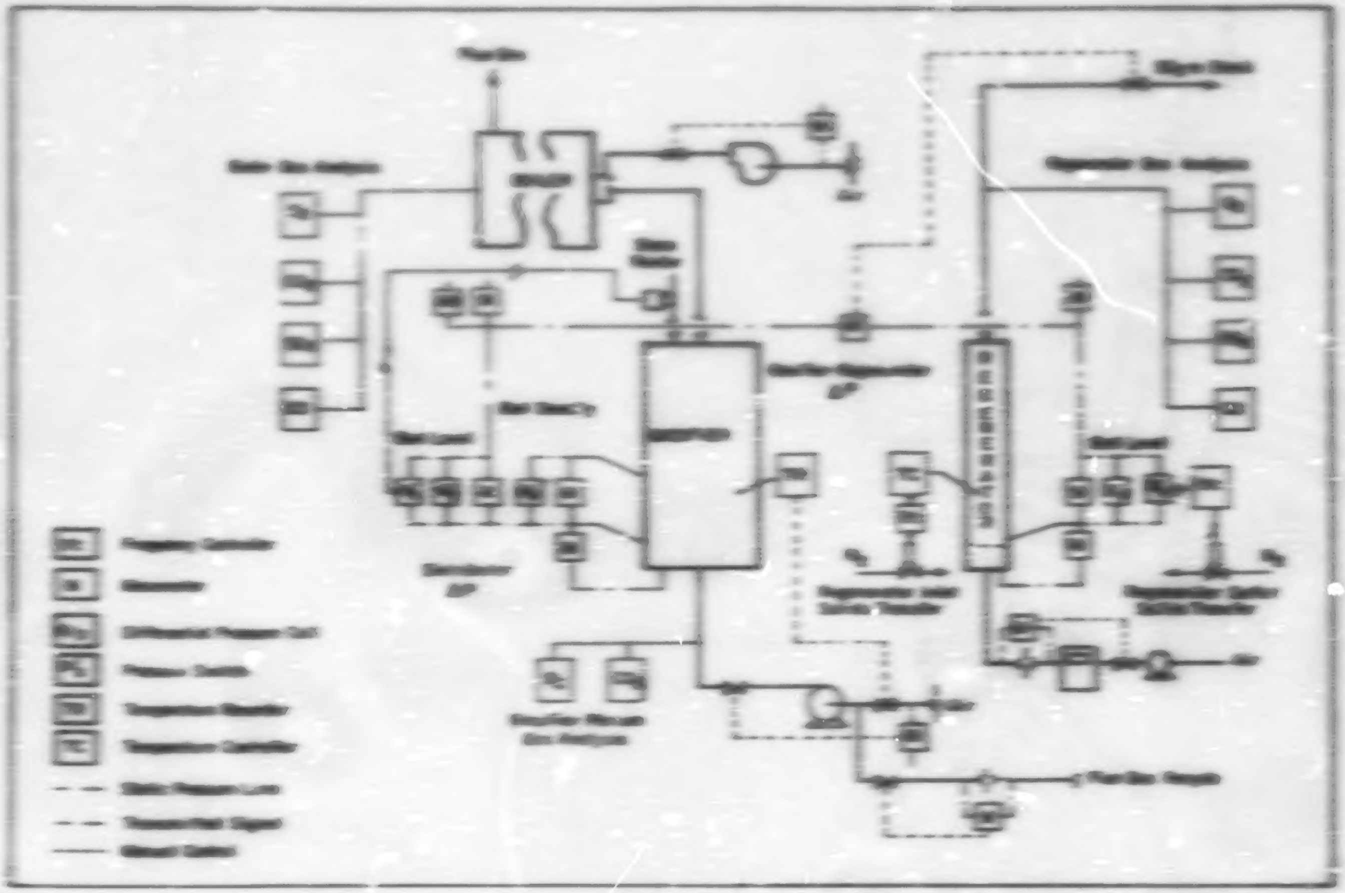
SECTION



PLAN

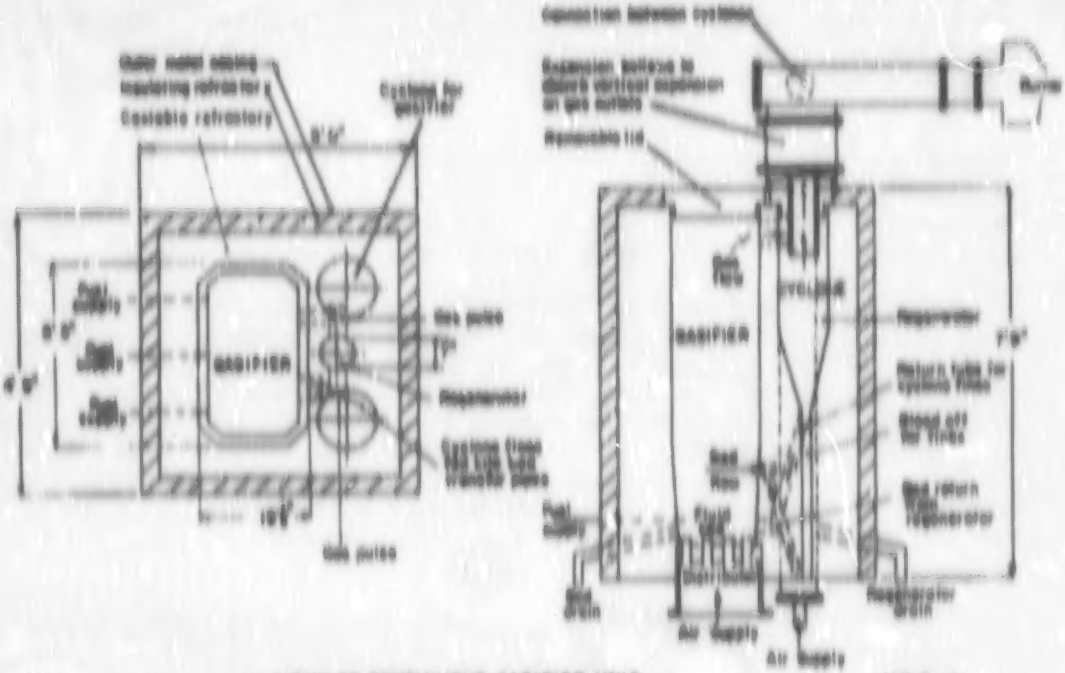
FIG.2.2.

CAFB PILOT PLANT INSTRUMENT FLOW PLAN



GASIFIER-REGENERATOR UNIT*

The gasifier and regenerator reactors are cavities in a single refractory concrete block. The block contains other cavities which make up the gasifier outlet cyclones, the gas transfer ducts, and the transfer lines through which solids circulate between gasifier and regenerator. Figure I-4 is a drawing of this gasifier-regenerator assembly. The gasifier cavity is rectangular in cross section, tapering from 17.5 x 37 inches at the distributor level to 19.5 x 39 inches at the 21 inch level. The upper portion has parallel sides. The regenerator tapers from 7" diameter at the bottom to 8" diameter 22" above distributor datum and remains parallel thereafter.



LAYOUT OF CONTINUOUS GASIFIER UNIT FIG.I-4

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* Basis Unit - see Appendix E for Modifications

The gasifier air distributor consists of 32 nozzles each of which contains horizontal holes arranged in an offset manner with a ¼" diameter final hole to reduce the gas velocity. The nozzles are stainless steel mounted on a refractory covered carbon steel plenum.

The regenerator distributor consists of 5 stainless steel nozzles each with 4, 1/8" holes which are not equally spaced around the periphery having a closer pitching around the outer side of each nozzle.

THE STONE HANDLING SYSTEM

Limestone is fed to the gasifier through a gravity feed line from a pressurized weigh hopper. A vibrator is used to control the rate of stone addition. A ground level hopper is charged from bags of stone. A pneumatic transfer line moves the stone from the ground level hopper to an upper hopper from which stone is periodically dropped into the weigh hopper. The upper hopper acts as an air lock to avoid depressurizing the weigh hopper.

MAIN BURNER DESCRIPTION

The standard oil burner of the 10 million Btu/hr boiler was replaced with an experimental burner designed to handle the hot gasifier product.

A general arrangement of the gasified fuel burner is shown in figure I-5. It will be seen that the air required for complete combustion is introduced in 3 stages. Roughly about 10% of the air enters a crude injector (1) and is premixed with the gas. Further premix may be introduced at point (2) and the remainder of the air is fed tangentially into a swirl chamber and emerges from an annular nozzle which is concentric with the gas nozzle. The design of this burner was purely empirical and was based on recommended pressure drops at the nozzle. The main gas duct is sized to give a flow velocity of about 60ft/second, the gas nozzle gives a pressure drop in the region of 3" w.g., and the air nozzle gives a pressure drop of about 4-5" w.g.

A pilot light fired by propane gas is used for lighting purposes.

ANALYTICAL SAMPLING AND INSTRUMENTS

On stream analysers monitor the compositions of the key gas streams. Table I-1 lists those analysers and their applications whereas Figure I-6 gives a flow diagram of the equipment layout.

TABLE 1

CAFB Pilot Plant Gas Analyzers

Gas Stream	Component	Analyzer	Operating Principle	Range
Air-Flue Gas Mix to	O_2	Servomex OA 250	Paramagnetic	0-25% by vol.
Gasifier Plenum	CO_2	Maihak Unor 6	Infra Red	0-10% by vol.
Boiler Flue Gas Sampled at fire tube outlet	O_2	Servomex OA 137	Paramagnetic	0-5% by vol.
	CO_2	Maihak Unor 6	Infra Red	0-20% by vol.
	CO	Maihak Unor 6	Infra Red	0-20% by vol.
	SO_2	Maihak Unor 6	Infra Red	0-1000 ppm
	SO_2	Wösthoff	Electrical conductivity of H_2O_2 - SO_2 reaction products in solution	0-1000 ppm
	SO_2	Hartmann & Braun	Infra Red	0-1000 ppm
Regenerator	O_2	Servomex OA 137	Paramagnetic	0-2.5% by vol.
	CO_2	Maihak Unor 6	Infra Red	0-10% by vol.
	SO_2	Maihak Unor 6	Infra Red	0-20% by vol.

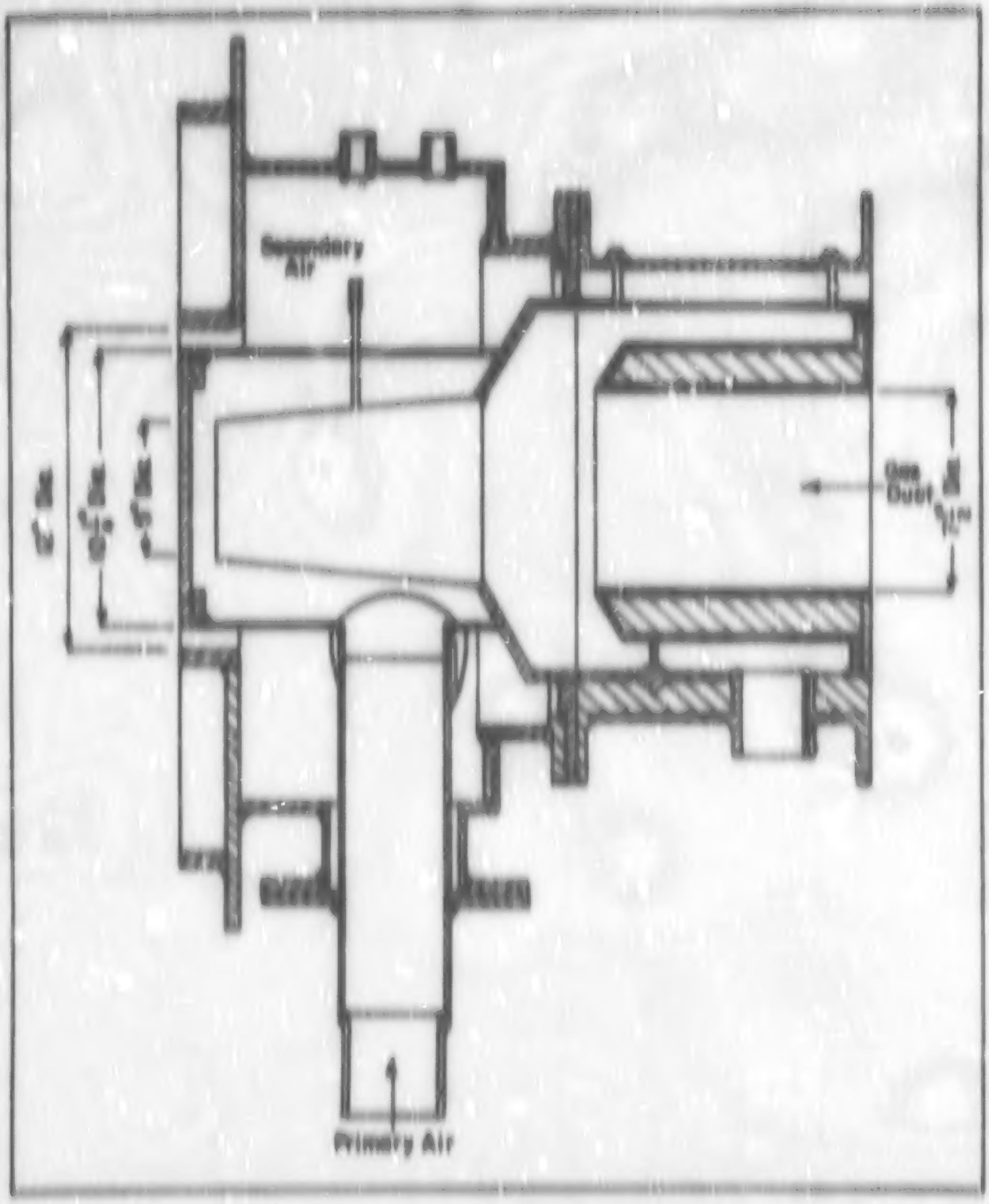

FIG. 15

CAFB PILOT PLANT

FLOW DIAGRAM FOR GAS ANALYSING EQUIPMENT (RIG 4-MS3)

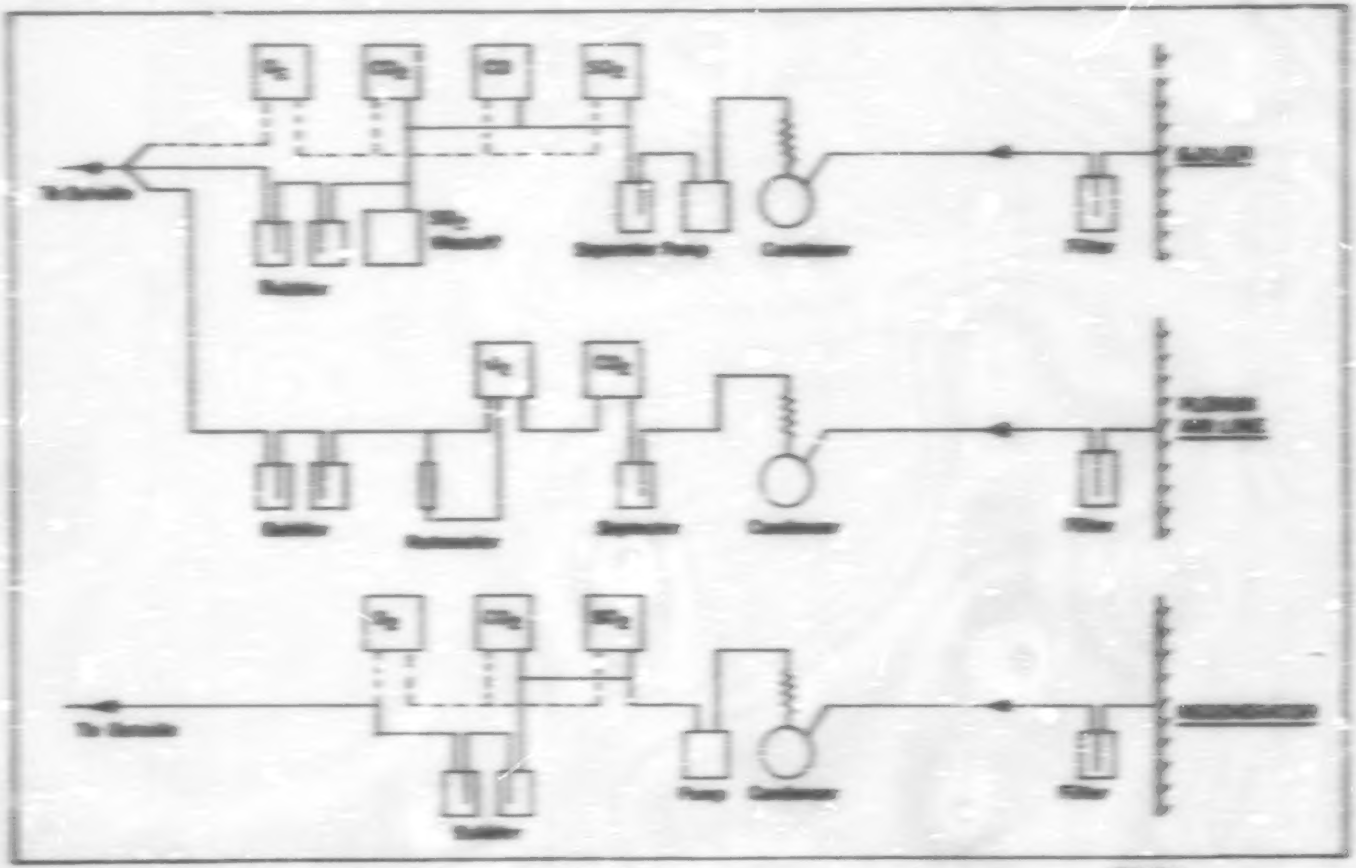

FIG 2.6

BOILER AND PRESSURISATION SYSTEM

A handbook containing details of the boiler and pressurisation unit will be kept in the crew room. If problems occur with this equipment which is not immediately apparent call for help.

SAFETY ALARM SYSTEMS

1. Types of Action

The installation is protected by a number of alarm circuits, in some cases the consequence of an alarm is automatic where immediate safety is concerned, but many others are warnings of some changing condition where there is time for corrective action.

Action A.

This action is an automatic plant shut down and produces the following actions:-

- Fire valves close on oil feed and return lines at entrance to building.
- Oil circulation pump stops.
- Gasifier control panel shuts down everything apart from main air blower on the boiler, primary and secondary cooling circuits of the boiler cooling system blowers on 3rd stage regenerator boost and pressure control (regen off gas).
- Interior and exterior bells ring at 3P, which may be silenced by a mute button on the auxiliary panel in the air lock passageway.
- Red light shows on the auxiliary panel and also on the gasifier control panel warning light for the auxiliary panel.

Action B.

- Alarm light shows on gasifier control panel and rings a bell on the panel which may be muted for that particular alarm by a switch located above that alarm light. Automatic gasifier shut down is not possible with action B.

Action C.

- Alarm light shows on gasifier control panel which can be linked to a gasifier shut down by selecting the switch on the panel to "Automatic Shut Down Mode". This alarm will ring a bell unless muted.

Action D.

- Alarm light shows on gasifier control panel - cannot ring a bell or cause an automatic gasifier shut down.

Action E.

- o Alarm light on auxiliary panel and light on control panel.
- o No other action.

Action F.

- o Horn type warning sounded in 3F, 3A and the grinding room.

Action G.

- o Low pressure in the pressurisation unit causes a unique operation - namely - a bell on pressurisation unit, light on gasifier control panel, auxiliary panel warning light, and automatic shut down of all equipment controlled from main panel but not air to burner, cooling pumps or shut down of fire valves or oil circulation pump.

V. Alarm Sources

The installation is best considered as four main systems.

- o The boiler and its cooling system.
- o The gasifier.
- o The experimental burner on the boiler
- o General alarms.

V.1 The Boiler and its Cooling System

The water in the boiler is pressurised to about 45 psi and is pumped through a heat exchanger. The secondary side of the heat exchanger is cooled by an evaporative cooler on the roof of the building.

Primary Circuit Protection

- o The pressurisation unit has a low pressure warning set at 40 psi.

Action G

- o High water temperature in the boiler water - set at 245°F.

Action B

Secondary Circuit Protection

- o Lack of cooling water flow is detected by a differential pressure switch across feed and return lines to cooler. This switch is alarmed if the pump is switched on and the differential pressure is less than 5 psi approx.

Action A

- High water temperature to cooler - a mechanical reset overtemperature alarm set in the vertical leg from the heat exchanger - operates at 200°F. The reset button is 10 ft up the vertical leg.

Action A

2.2 The Gasifier and Regenerator

The gasifier has a variety of temperature alarms and high or low pressure alarms.

- High temperature in the gasifier bed - usually set to 950°C - set, shown and alarmed from Guardian controller.

Action B

- High temperature in the regenerator bed - usually set to 1100°C - set, shown and alarmed on Leeds and Northrups recorder.

Action B

- Gasifier distributor low pressure drop - set to 5" w.g. by pressure switch - letter E. (Under control panel.)

Action D

- Regenerator distributor high pressure drop - set to 40" w.g. by pressure switch - letter D. (Under control panel.)

Action D

- Regenerator low bed level - set to 10" w.g. by pressure switch - letter F. (Under control panel.)

Action D

- Regenerator high bed level - set to 30" w.g. by pressure switch - letter G.

Action D

- Pressure rise in gasifier gas space - set to 24" by pressure switch C.

Action B

9.3 Main Burner and Pilot Burner

Main Burner

The main burner flame can be scanned by 2 detectors, one at each end of the boiler and failure of both will cause alarm C.

Pilot Burner

The pilot burner will only light up if there is gas pressure to the pilot and air pressure to the experimental burner plenum.

If the fireye which scans the pilot does not see sufficient flame it will cause the pilot to lock out and show as an alarm light. Failure of gas pressure or plenum pressure will have the same result. It is not possible to check action of fireye without attempting start up.

Action D

9.4 General Alarms

- N_2 supply failure - Action D
- Fire detector - a fusible link above the boiler set to melt at 155°F will cause

  Action A

  This link needs to be replaced after operation and because it may not be convenient to isolate the power at that moment a bypass electrical switch has been fitted on the auxiliary panel as a temporary procedure until the link can be replaced. Replacement must be done as soon as possible.

- Sump level

  If the level in the sump rises to about 1/8" of floor level a light will show on the auxiliary control panel, the main panel will not be alarmed and no bells will ring.

  Action E

- Emergency Stop Buttons

  There are four emergency stop buttons located:

  - Close to the sliding window in cubicle
  - Main door at 3A end of laboratory
  - Main door at main stores end of laboratory
  - Adjacent to ladder on side of the pit

  Action A

These must be reset by turning knob and allowing knob to spring back.

- Emergency Stop Button On Main Control Panel

  Located in centre of gasifier control panel and shuts down all items controlled from this panel but does not shut down fire valves, cooler pumps, air to burner, or oil circulating pump regenerator boost or pressure control blowers. Reset by turning ring and allowing button to return.

  The fire valves and oil circulating pump can be shut down by then depressing the emergency stop button by the sliding window.

  i.e. Action A

- Call for Assistance

  There are four buttons located on each wall of the pit with a further button on the cubicle wall at the top of the pit steps. These sound horns in 3A, 3F and the grinding room.

- Fuel Shut Off Valves

  In the event of an emergency shut down where there is any possibility of fire the propane gas and kerosene must be isolated at their external valves. The propane valvs is situated at the external corner of the building adjacent to the supply feeder from the propane line. The kerosene valve is located by the barrel stand adjacent to the semi buried storage tank.

Summary of Pilot Plant Alarm System

Source of Alarm	Indication Auxiliary Panel	Indication Main Control Panel
1. Failure of water circulating pump or lack of water in secondary cooling circuit	Red Light and bells	Red light titled "Auxiliary Panel"
2. High water temperature on cooler feed line	Red light and bells	Red light titled "Auxiliary Panel"
3. High water temperature in the boiler	None	Red light titled "Boiler high temperature"
4. Low pressure in pressurisation unit.	None	Red light titled "Auxiliary panel"

N.B. Red light shown on pressurisation panel, and its own bell rings

5.	Gasifier high temperature	None	Gasifier high temperature warning light and bell
6.	Regenerator high temperature	None	Regenerator high temperature warning light and bell
7.	Gasifier low pressure across distributor	None	Gasifier low pressure distributor warning light
8.	Regenerator high pressure across distributor	None	Regenerator blocked distributor warning light
9.	Regenerator low bed level	None	Regenerator low bed level warning light
10.	Regenerator high bed level	None	Regenerator high bed level warning light
11.	Pressure rise in gas space	None	Downstream pressure rise warning light and bell
12.	Experimental Burner & Pilot Failure of: Main Flame	None	Main flame failure warning light and bell
	Pilot Flame	None	Pilot flame warning light & bell
13.	N_2 supply failure	None	Warning light and bell
14.	Fire detector	Red light and bells	Redlight titled "Auxiliary Panel"
15.	Sump level	Red light	Nothing
16.	Emergency stop buttons in building	Red light and bells	Red light titled "Auxiliary Panel"
17.	Emergency stop button	None	None

11 OPERATING PROCEDURES

Safety

There are many possible hazards in the CAFB operation, and it is essential that every person works carefully and safely. The plant must be operated by a three man team unless it is a warming up operation when two man operation is permissible provided the activities are limited to recording and controlling the temperature.

If it becomes necessary to unter the pit at any time there must be two men available at the top of the pit to render assistance should the man in the pit get into difficulties. Two sets of breathing masks fed from bottles of breathing air must be available, one for use by the man in the pit, and one for the man standing by at the top of the pit.

Whilst every precaution has been taken to reduce the dust in the laboratory area by local dust extraction ducts it may be necessary to wear respirators when in this area when certain actions are carried out. Please ensure that you change the filters regularly and wash out the respirator after use.

There are also three positive pressure respirators which are powered by rechargeable batteries fixed to the belt which also houses the blower and filter unit. These are available for general use, but people must thoroughly wash the mask (as instructions) after use, and ensure that the battery is recharged.

Spare primary and main filters are available.

Ear protection is available either as ear cups or Bilsholm wool plugs - individuals may find that the use of this protection reduces fatigue after long periods of time in the noisy area.

Eye protection must be worn at all times and in some cases full goggles or face shields must be used if there is a danger of hot or dusty material being thrown or dropping onto the face.

Asbestos gloves are available and particularly must be worn when draining hot lime samples from the unit or any other operation involving hot material. Light weight gloves are available for general use.

A safety helmet has been purchased for each person, and it is important that these are always worn when in the gasifier area. If they are too bulky for some operations there are some hard hats available for general use in such circumstances.

In time of trouble assistance may be called by use of the alarm buttons which sound outside the laboratory in 3A and the stone storage garage.

Fire

There are three powder fire extinguishers - one in the control cubicle and two in the gasifier area. Be familiar with their location and method of operation, but remember that their operation time is short and they will only deal with small fires. Also available are two portable CO_2 extinguishers - one in the crew room and one in the gasifier area near the control room door.

There is a CO_2 hose reel on the wall immediately outside the main sliding door - there are two spare full CO_2 cylinders on the wall adjacent. The main reel must be immediately recharged with the two new bottles after it has been used.

There is a fire hydrant close to Featherbed Lane near the main door. The hose will be laid out as a safety precaution with an adjustable spray nozzle/single jet fitting located on the end.

Fuel and N_2 Supply Pre-run Checks

(a) Heavy Fuel Oil

- Check tank contents.
- Check outflow temperature is about 140/150°F.
- Start compressor/oil pump on boiler by switching on at panel. Do not run for more than five seconds at first few runs in order to get thick oil moving. Continue until temperature gauge on outflow heater reaches 200/210°F and then pump may be left on.
- The boiler heater circuit is now on automatic operation and is ready for use.

(b) Kerosene

- Stored in 500 gallon tank - check that there is enough for anticipated usage. First check that isolating valve is turned off on pump supply feed pipe. Then open valve at barrel. Check fire valve has not actuated.

(c) Nitrogen

- Stored in liquid N_2 tank. Check that there is sufficient for anticipated usage. Air Products (Bracknell) must be alerted to make daily "topping up" visits during the operational period.

- Check all valves are turned off at the bleed locations on gasifier before opening valve on manifold.

(d) Propane

- Check valve on tank and valve outside building 3F is open.

Boiler and Systems Pre-run Checks

- Check water level in pressurisation unit header tank is at marker.
- Make up water supply open to tank.
- Pressurisation unit on: check N_2 pressure is approximately 40 p.s.i.
- On start up bell will ring. Cancel bell. N_2 off at cylinder.
- Air bled from boiler cooling circuit.
- Valves open from water reservoir to cooling tower located on first floor of water tower (valve is labelled).
- Notify site services of soft water usage.
- Start boiler circulating pump.
- Start cooling tower circulating pump; hold cut-out for 15 seconds.
- Power on to cooling tower fan.
- Check automatic mixing valve working (temperature setting 160°F).
- Open cooling system purge. Check for flow in drain pit by blower house.
- Switch boiler panel on.
- Check fuel oil circulation in ring main.
- Check fuel oil circulation in boiler circuit.
- Check line up of three way valve for flow through boiler circuit heater.
- Check water pressure in boiler is approximately 40 p.s.i.
- Check sample lines are correctly installed in flue.
- Boiler door shut, held on four bolts.
- Ensure flue damper fully open.

Gasifier Pre-run Checks

- The gasifier is assumed cold and empty of bed.
- Check bolts O.K.
- First stage blower.

- Second stage blower.
- Regenerator blowers.
- Extract blower.
- Vacuum cleaner for stone feed.
- Lubrication
- Fuel circulating pump.
- Fuel metering pumps (3).
- First stage blower.
- Second stage blower.
- Recycle blower.
- Regenerator blowers (3).
- Main burner blower.
- Extract blower.

- Tuyere blower.
- Cubicle blower.
- Cooling tower water circulating pump.
- Boiler water circulating pump.
- Oil circulating pump under boiler.
- Bitumen circulating pumps (2).
- Bitumen metering pumps (2).
- Analysers
- Sample lines.
- Calibration.
- Pumps working.
- Filters and traps.

Gasifier Warm Up

- Check action of alarms.
- Alarm switch to "all alarms show".

- Bell switches to MUTE.
- Auto shutdown switches to inactive.
- Main panel power on.
- Instrument air on - 80 p.s.i.
- Instruments on and working - charts O.K.
- N_2 supply to ring main - 40 p.s.i.
- N_2 to pressure tap bleeds - 2.5 CFH each.
- All manometers full.
- D/P cells zeroed.
- Regenerator blower on - 5 CFM flow.
- Check water level in Compton supply seal - 9 FT.
- Line up to Comptons. Check operation. Set to 3 p.s.i.
- Switch off Comptons, line up N_2 via by-pass which avoids meters.
- Adjust N_2 to 3 p.s.i.
- Pocket agitator N_2 flow to 4 CFH.
- Injector N_2 flow to 0.3 CFM.
- Start pulsers and check action.
- Check solenoid action and line-up to main (N).
- Regenerator temp control on manual.
- Regenerator control switch behind panel to "off".

Pre-Heat Burner Light Up

- Close valve in line from stone feed hopper to gasifier.
- Open line to low range orifice for gasifier air.
- Ensure high range orifice inlet blanked.
- Ensure:- Propane gas line to burner open (three valves, on propane tank, outside and inside Building 3P).
    - Igniter and flame eye connected.
    - Visual sight glass clean and tight.
    - Purge to flame eye connected (4 CFH).
    - Burner air valve open and throttle shut.
- Start both gasifier air blowers, set to 150 CFM.
- Ensure flue gas recycle valve closed.

- Ensure burn out connection shut.
- Close plenum air valve and open burner throttles.
- Compare burner air flow indicator and gasifier air flow indicator.

- Check zero setting of both air flow gauges.
- Open plenum air valve and set throttle to marking 1.5.
- Adjust burner air to 30 CFM.
- Check regenerator air - 5 CFM.
- Air to fuel lower side injectors - 5 CFM each.
- Check centre fuel injector retracted and N_2 purge to sleeve to 0.7 CFM, and small air flow to injector.
- Upper side injectors retracted and 4 CFM air bleed injected.
- Start boiler burner blower - 200 CFM.
- Air flow to stone feed - 90 L/Min.
- N_2 flow to each fines return systems - 4 CFM.
- 4 CFM N_2 bleeds to fines returns lines.
- Start regenerator pressure control blower, and set G/R ΔP controller to zero.
- Check that propane pressure reads 30 p.s.i.
- Turn on electric power to start up burner control.
- Open pilot propane cock in the control room.
- Close cock slightly on air to pilot to reduce pressure.

- Activate start up burner control and go to propane throttle by gasifier.
- Adjust propane flow to 40 CFM as soon as propane solenoid opens.
- Shut off pilot cock in the control room when white dot visible on the controller, and adjust burner air flow to 40 CFM.
- If flame does not lock on, allow one minute purge before starting again - from "open pilot propane cock in the control room", reset burner air flow to 30 CFM.
- Adjust back pressure to send hot gas to regenerator by increasing G/R ΔP but avoid excess temperature in R to G return pocket as measured by temporary thermocouple.
- Control the temperature on return pocket by adjusting G/R pressure balance.

- Increase flow of regenerator air if necessary.
- Monitor temperatures and adjust gas and air flows to follow temperature schedule of 15°C per hour.
- Maintain air/fuel ratio in the burner of 1 CFM/1 CFH and about 130 CFM air flow through the plenum.
- Sequence for increasing the propane firing rate is:
    - Increase total air (motor valve).
    - Increase propane rate.
    - Adjust burner air.
    - Open plenum air throttle as required.

Pre-Heat Burner Flame Out

- Flame out: In case of flame out allow one minute purge time, identify cause of failure and correct eg dirty fire eye then follow "pre-heat burner light up" from the line "open pilot propane cock in the control room". When re-lit increase propane and air (including plenum air) to the value before flame out and continue raising temperature.
- Observe for hot spots on the shell - correct by stopping leaks with fibrefrax or asbestos and sairset and by water spray.

Heavy Fuel Oil Pump Calibration

- Close fuel valves to injectors.
- Open sampling valves.
- Verify trace heating on and pipes hot.
- Line oil through to the metering pumps and calibrate.
- Check operation of 80 p.s.i. overflow valve.
- Line up fuel to centre injector.
- Turn off fuel oil, turn on kero and line through to kero barrel, disconnect oil line to centre injector in the pit and clear through any F.O. into a bucket with kero (avoid spillage and have dry powder cylinder available). Reconnect oil line to centre injector.

Change From Propane to Kerosene

- When gasifier temperature reaches 700°C raise centre injector to 3" and begin kero injection at very low rate with 5 CFM of air.

- Gradually replace gas flow with kero while increasing plenum air flow to 250 CFM and lowering propane to 50 CFM.
- Line up air supply to the fines return control panel.
- Adjust air to fines return pulser to 3 p.s.i.
- Set bleed below ¾" Audco on each fines return pipe to 4 CFH and open the Audco valve.
- Set N_2 to each fines return injector to 4 CFM.
- Set timers on fines return control panels to 5 min. cycle and switch on.
- N_2 rate to fines return injectors and timers on the fines return panel may need adjustment once the system settles.

Starting Stone Feed

- Record weight of limestone supply and fill ground level feed hopper.
- Close main valve and balance valve between stone hoppers.
- Start motor on transfer vacuum line.
- Open valve on vacuum line and valve on fill line and suck stone up to overhead hopper.
- Close fill line and vacuum line valves.
- Equalise pressure between stone feed hoppers by opening balance valve.
- Open big valve between hoppers and drop lime into lower hopper.
- Check that weigh cell is working - record weight change.
- Close main and balance valves between hoppers.
- Check N_2 pressure to injectors is 3 p.s.i.
- Open N_2 to meters.
- Check bleeds to injectors and agitators (0.5 CFM, 4 CFH respectively).
- Set bleed N_2 flows to pressure tappings (2.5 CFH).
- Pressurise outer casing of gasifier to 10" WG and note flow rate.
- Check manometer fluid levels.
- Increase regenerator air flow to 15 CFM.
- Adjust pressure balance to stop G to R gas flow.
- Check regenerator to gasifier injector bleed is at 0.3 CFM.
- Check that temperature at G to R pocket is below 1,000°C.
- Start rapper stack cyclone.

- Do following to start stone feed:
    - Start 1 CFM N_2 to stone hopper vessel.
    - Open valve between hopper and gasifier.
    - Start vibrator feeding lime at 50 lb./hr.
    - Check that lime is being fluidised.
    - Increase lime rate as conditions permit - keep bed temperature above 850°C.
- Check that the cyclone drains and fines return system operates satisfactorily:
    - Visually from tops of cyclones.
    - Visually through tops of boxes.
    - Observe valve opening and closing sequence.
    - Check that valves are opening and closing fully.
- As bed depth increases to near 5" you may need to increase the propane pressure by screwing down the propane pressure reducer. Count the number of turns and record in log book.
- When bed depth reaches 5" with good kero combustion.
- Close main valve in propane line to burner.
- Turn off power to start up burner control.
- Close air valve adjacent to burner, 2" ball valve.
- Start 4 CFM air to burner purge.
- Stop combustion air to start up burner.
- Open plenum throttle and adjust plenum air to 170 CFM using motor valve.
- Adjust kerosene rate to maintain 870°C - note rate in log.
- Adjust regenerator pressure to 3-4" below gasifier.
- Adjust pulsers to obtain good solids circulation.
- Continue addition of limestone to specified level.
- Check regenerator drain operation.
- Check cyclone drain system as specified above.
- Timing of the fines return cycle may need changing.

Boiler Clean Out

- Line up equipment and manpower to clean out boiler:
    - Rake.

  - Breathing apparatus.
  - Door bolts.
  - Spanners.
- Stop stone feed vibrator.
- Close valve between stone feed and gasifier.
- Stop N_2 feed to stone hopper.
- Raise gasifier temperature to 950°C.
- Perform following operations in quick sequence to interrupt combustion and hold temperature.
  - Stop fuel pumps and close fuel line valves.
  - Switch off gasifier blowers.
  - Close hand valve in air line to plenum.
  - Stop regenerator air blower.
  - Turn bed transfer pulsers to 10/8.
  - Reduce air to all fuel injectors protruding into bed to 1 CFM.
  - Stop air to stone feed.
  - Stop N_2 to fines return.
  - Stop cyclone drain controllers.
  - Stop regenerator P control blower.
- Perform following operations rapidly to prevent too much temperature loss in gasifier bed.
  - Clean solids from boiler tubes.
  - Remake boiler door seal with ½" rope + bostick and close door.
  - Check that main flue damper is open.
  - Check flue gas recycle valves are closed.
- When all is ready, and before bed temperature falls below 700°C resume combustion by following steps in quick order:
  - Start air to protruding fuel injectors - 5 CFM each.
  - Start blowers and open air to plenum, check fluidisation.
  - Open fuel line valves and start pump at rate for steady 870°C (see log).
  - Start air to stone feed.
  - Start N_2 to fines return.

  - Start air to regenerator and adjust to 15 CFM.
  - Start regenerator P control blower.
  - Start cyclone drain controllers.
  - Increase pulser rates to 5/1.
- Raise gasifier temperature to 870°C.
- Resume stone addition:
  - N_2 to stone hopper.
  - Open feed valve.
  - Start vibrator.

Start Main Flame Pilot Light

(a) Main Flame Out

- Clean fire eye and start purge air in control room (60 l/min.).
- Set main burner air to 600 CFM.
- Line up all three propane valves to pilot burner.
- Check propane pressure at 30 p.s.i.
- Open air valve to pilot burner (set at 12 CFM, pitot 0.1).
- Turn on power to pilot burner control.
- Start control sequence.
- When propane opens check flow is 1.9 CFM.
- When lit check stability by inspecting.
- Increase burner air to 800 CFM.
- Check pilot stability.

(b) Main Flame On

- Clean fire eye and check purge at 60 l/min.
- Line up all three propane valves to pilot burner.
- Check propane pressure at 30 p.s.i.
- Open air valve to pilot burner (set at 12 CFM, pitot 0.1).
- Check power on to pilot burner control.
- Start control sequence, but hold in cut out button until propane pressure gauge needle flicks to maximum position and release button.

- Check propane flow is 1.9 CFM.
- Reset pilot burner alarm and cancel mute.

Change From Kerosene Combustion to Fuel Oil Combustion

- Activate alarm cells - except main flame.
- Check cooling system - levels, pressures, flows + set bleed, make up valve in water tower open.
- Check that hand valve (Pit) in the flue gas recycle line is closed and F.G.R. orifice gives zero reading.
- Line up valves from boiler flue through F.G.R. blower and filter to blower house inlet.
- Start flue gas recycle blower.
- With motor valve fully closed, open hand valve (Pit) in F.G.R. line.
- Open flue gas recycle motor valve to give 30 CFM.
- Set plenum air supply to 170 CFM.
- Adjust kero feed rate to give steady 870°C.
- Check that trace heating to oil feed lines is on and hot.
- Close kero valve and open fuel oil valve. Leave pump running and adjust back pressure to 40 p.s.i.
- Stop stone addition:
  - Stop vibrator.
  - Close feed valve.
  - Stop N_2 to hopper.
- Start air bleed to flame fire eye at boiler back end.
- Check operation of boiler main flame fire eyes (2).
- Re-install and check isolating valve open for rear door fire eye and tapping clear of lime.
- Check rear door main flame fire eye light shows on boiler control panel.
- Switch off Middle and R.H. metering pumps and adjust L.H. pump to give steady 870°C for an hour. Record all flows and temperatures and any relevant comments in the log book.

Change Over From Combustion to Gasification

- Ensure that combustion is steady on L.H. pump only, Middle and R.H. off.
- Set Middle pump to 56 lb./hr.
- Set R.H. pump to 146 lb./hr.

- Stop L.H. pump and start Middle pump. Adjust back pressure to 40 p.s.i. if necessary.
- Control bed temperature by intermittent operation of Middle pump - estimated 50% on 50% off.
- Set L.H. pump to 146 lb./hr.

__To Gasify__

- Verify boiler pilot alarm and check presence of flame visually.
- Verify all other alarms and operation of main flame fire eyes (which respond to torch light).
- Set high temperature bed alarm to 1,000°C.
- Main flame failure and auto shut-down inoperative.
- Switch Middle pump off and allow bed temperature to fall to 850°C.
- Switch Middle pump on to purge boiler with inerts (10 sec.).
- When bed temperature rises to 870°C do the following simultaneously and rapidly:
  - Switch on L.H. and R.H. pumps.
  - Start stop watch.

  8 sec. - reset main flame failure alarm.
  - If M.F.F. alarm cancelled switch off M.F.F. alarm mute and activate auto shut down.

    Proceed to "on gasification".
  - If M.F.F. alarm did not cancel do as follows:

  9 sec. - reset M.F.F. alarm:
  - If M.F.F. alarm cancelled, do as at 8 sec.
  - If M.F.F. alarm not cancelled do as follows:

  10 sec. - reset M.F.F. alarm:
  - If M.F.F. alarm cancelled do as at 8 sec.
  - If M.F.F. alarm not cancelled do as follows:

  11 sec. - reset M.F.F. alarm:
  - If M.F.F. alarm cancelled do as at 8 sec.
  - If M.F.F. alarm not cancelled:

    Switch off L.H. and R.H. pumps.

    Reset L.H. pump to steady combustion rate (approximately 30 lbs./hr.).

Switch off Middle pump before gasifier temperature reaches 1,000°C but not less than 10 secs. after L.H. and R.H. pumps off.

Switch on L.H. pump.

Line out on combustion at 870°C.

Attempt to find out what went wrong, rectify if necessary and repeat from "change over from combustion to gasification".

On Gasification

- Switch off Middle pump.
- Reset high temperature bed alarm to 950°C.
- Adjust metering pumps' pressure to 40 p.s.i. (if necessary).
- Check for leaks on gasifier and seal if necessary with fibrefrax and sairset.
- Resume stone addition:
  - N_2 to hopper.
  - Open valve between hopper and gasifier.
  - Start vibrator.
- Adjust flue gas recycle and air rates to obtain specified temperature and gas velocity.
- Adjust stone circulation rate to obtain desired regenerator temperature.
- Put regenerator temperature control on automatic:
  - At controller.
  - Behind panel switch to "on".
- Check cooling system operation; set cooler control to 160°F.
- Bring conditions to specified level.

Trouble-Shooting on Steady State Conditions

- *Do not* change any control settings unless one or more of the listed deviations occur.
- Ensure:- preventive maintenance procedures are carried out.

Watch
- O_2 level in the flue gas.
- Gasifier Bed Temperature.
- Regenerator bed temperature.
- Gasifier top space pressure.

- Fuel delivery pressures.
- Fines return system.
- Regenerator CO_2 and SO_2.
- Compton pressures.
- Boiler flue gas exit temperature.
- Gasifier bed depth.

- Enter in the log book, details of any incidents which occur, together with the time of occurrence and the remedial actions which were taken.

- Possible Incidents due to Malfunction

1. Bed Temperature Starts to Rise Rapidly

(a) Check O_2 level in flue gas. If this is rising then the fuel is not getting through to the gasifier.

(b) If O_2 level is normal check the stone feed and see that this is functioning properly. If not try adjusting the feed rate, and other remedial actions such as refilling the hopper.

(c) If the O_2 is rising then check the fuel pump delivery pressures. If these are high (80) then fuel may be by-passing the injectors and blowing out into the dump can. In this case check the dump pipe outlet for oil flow and adjust the fuel pressure control valve to bring the pressures both to 40 p.s.i.g.

(d) If opening the fuel valve will not lower the pressure then either the fuel injector is blocked or else there may be emulsion in the fuel. Try switching the fuel to the alternate injectors. If this does not ease the trouble then switch back to the previous fuel tank and call for help. If the fuel shortage persists then eventually there will be a flame-out and the unit will shut down automatically. Initiate emergency shut down procedure.

(e) If the fuel pressure is low with rising bed temperature then the fuel tank may be empty. Check this and swap tanks if necessary.

2. Regenerator Temperature Rises Rapidly

The regenerator temperature actuates an alarm at 1,100°C and a nitrogen quench if valve is open. If it suddenly rises the chances are that the bed transfer system is inoperative.

(a) First check the Compton pressures, these should be about 5 p.s.i.g. If they are low then the Comptons will have stopped; switch to the alternative nitrogen supply.

(b) If on automatic control, check the rate at which the gasifier to regenerator pulser is working. If this is very rapid then it will be inoperative. Switch to manual and adjust to a reasonable rate, i.e. greater than 5/1, which brings the temperature back into line.

(c) If the temperature is excessive and must be reduced quickly, use the regenerator pressure control valve to swing the pressure differential between the gasifier and regenerator. This will rapidly exchange bed material and will temporarily bring the regenerator temperature down.

(d) If manual control does not work, and the gas supply is satisfactory then there may be a blockage in the gas injectors. Go down into the pit, check and rod out injectors, bleeds and transfer lines, if necessary.

3. Fines Return N_2 Pressure Rising

This indicates a blocked fines return pipe. Switch off the corresponding control panel and rod out the pipe.

4. Cyclones Not Draining Properly

This is indicated by cyclone drain temperature dropping steadily, and can be verified by a visual check through sight glasses in the top of the cyclone and on the box. Check valve operation; if not satisfactory then rectify faulty valve. If blocked, rod out. If the blockage appears to be in the pulser then turn off the control panel, and turn off N_2 to injector and shut off the ½" Audco valve. Rod through the valve from below the puffer. As a last resort dismantle the puffer, clean out and replace.

5. Regenerator CO_2 Increases and SO_2 Decreases

This indicates that too much carbon is accumulating on the bed material. The remedy is to increase the air and flue gas supply to the gasifier to maintain temperature. Do not change the fuel rate because this is related to the stone feed rate.

6. Gas Space Pressure Increases

Prepare for planned shut down and decoke when the gas space pressure approaches 20" WG.

7. Automatic Shut Down

Initiate emergency shut down on gasification procedure.

8. Boiler Flue Gas Temperature Rises

If this temperature rises rapidly then the brickwork arch which seals against the boiler door will have developed a leak. Call for help when the temperature exceeds 500°F.

9. Back Up Pump on the Pressurization System Runs Continuously

Call for help.

10. Main Flame Pilot Light Goes Out

This will actuate the alarm bell. Try to relight the pilot using 'start main flame pilot light (b)' procedure, and if unsuccessful call for help.

11. Nitrogen Supply Failure

An alarm bell will actuate in control room. The transfer system/fines return system/nitrogen bleeds will fail. The Comptons will automatically switch off. The regenerator temperature initially will rise rapidly and you may need to activate the N_2 quench, but eventually the regenerator temperature will fall when carbon has been removed and stone sulphated.

Transfer nitrogen bleeds to cylinder supply. Identify cause of fault and rectify immediately if possible. If it is not possible to remedy fault within five minutes initiate planned shut down without sulphation. Note the N_2 plenum purge will need to be coupled to N_2 cylinder supply.

PLANNED SHUT DOWN OF GASIFICATION

- Possible reasons:

  (a) Prior to decoke.

  (b) Gasifier maintenance, e.g. removal of lime from plenum.

  (c) Boiler Back End Clean Out.

Two alternatives:

  (a) with sulphation.

  (b) without sulphation.

- If the reason for the shut down necessitates an activity in which the bed is exposed to the open air, then it is necessary to sulphate the bed to avoid formation of CO gas in the pit.

(a) With Sulphation

- Reduce gasifier temperature to below 850°C by increasing flue gas recycle rate.

- Switch regenerator temperature control to manual - switch behind panel to 'off'.

- Increase pulse rate to reduce regenerator temperature below 1,000°C.

- CHECK auto valve on cooler is functioning and pressure in pressurisation unit is O.K. (If auto valve not working be prepared for loss of pressure in pressurisation unit, e.g. arrange for back-up (hand) pump.)

- Shut vent from boiler sample cyclone with plug.

- Disconnect sample lines to boiler SO_2 analyser, and clip off so that other analysers can monitor boiler flue without sucking air.

- Shut off auxiliary air bleeds to gasifier -

  (a) Air bleed to lid if present.

  (b) Air to preheat burner purge.

  (c) Switch fuel injectors from air to N_2, set at 2 CFM (open N_2 FIRST).

  (d) Air to stone feed.

- Close stone feed valve.

- Close N_2 to stone feed hopper.
- Switch off stone feed vibrator.
- Close needle valve on air meter manometer to prevent blowing.
- Open flue gas orifice by-pass valve.
- Switch automatic shut down to 'inoperative' and mute main flame and pilot flame alarms.

Supervisor

- Switch off fuel pumps.
- Close gasifier air motor valve.
- Open FGR motor valve to give 140 to 200 CFM.

Man A

- As soon as M.F.F. light on, close throttles on main and premix burner air lines.

Man B

- As soon as M.F.F. light on, close fuel valves in control room, go to blower house and block off open air inlet.
- Control bed temperature to 900-950°C by regulating flow of air to main burner (use first primary air throttle). Oxygen concentration in flue gas recycle of ~10 vol.% is required (measured on plenum air O_2 meter).
- Sulphation is complete (~ 20 minutes duration) when oxygen levels increase and bed temperatures fall.
- When complete -

  (a) Shut off gasifier blowers.

  (b) Close plenum valve.

  (c) Close FGR valve in pit.

  (d) Reduce regenerator air flow to 3 CFM.

  (e) Close first primary air throttle to main burner.

  (f) Switch off fines return system.
  (g) N_2 to fines injectors to 1 CFM each.
  (h) Open needle valve on air water manometer.

(b) Without Sulphation

- Increase gasifier temperature to 930°C by shutting off flue gas recycle and/or reducing fuel supply to gasifier.
- Close FOR in pit.
- Shut vent from boiler sample line with plug.
- Disconnect sample lines to boiler SO_2 analyser, and clip off so that other analysers can monitor boiler flue without sucking air.
- Shut off auxiliary air bleeds to gasifier -
  (a) Air bleed to lid if present.
  (b) Air to preheat burner purge.
  (c) Switch fuel injectors from air to N_2 set at 8 CFM (OPEN N_2 FIRST).
  (d) Air to stone feed.
- Close stone feed valve.
- Close N_2 to stone feed hopper.
- Switch off stone feed vibrator.
- Mute main flame failure alarm.
- Switch off fuel pumps.
- Check blowers and pumps are off.
- Close regenerator blower outlet valve.
- Close plenum throttle.
- Close plenum valve tight.
- Open plenum throttle.
- Turn on plenum N_2 purge at 1 CFM.
- Switch off regenerator blower and fines return system.
- N_2 to fines returns to 1 CFM each.
- Close fuel valves.

Emergency Shut Down on Gasification

- When alarms ring and main flame failure shows:
  - Check blowers and pumps are off.

- Close regenerator blower outlet valve and burner purge.
- Close plenum throttle.
- Close plenum valve tight.
- Open plenum throttle.
- Check plenum N_2 purge at 1 CFM.
- Close air to stone feed.
- Close stone feed valve.
- Close N_2 to stone feed hopper.
- Switch off vibrator.
- Change fuel injector purges to N_2 and set at 2 CFM.
- Close fuel valves.
- Close off any air supply, e.g. to lid.
- Switch off regenerator blower and fines return systems.
- N_2 to fines return to 1 CFM each.
- Close FOR valve in pit.

The gasifier is now safe to leave slumped for at least one hour to investigate cause for shut down and rectify, or call for help. If the shut down is likely to last for more than 15 minutes purge through fuel oil lines with kerosene.

Probable Causes for Shut Down

- Failure of 12V stabilised power supply to main board.
- Interruption of mains supply/fire eyes dirty/not connected/eye ports blocked.
- Pressurisation unit lost pressure - pump failure/leak/non-ret valves.
- Failure of fuel supply - tank empty/filters blocked/fire valves dropped/water-oil emulsion.

Carbon Burn Out

- The procedure for carbon burn out is the same whether the shut down was planned (with or without sulphation) or emergency.
- Put plug on air inlet to gasifier blower.
- Put cap on outlet from sample cyclone.
- Close throttle on main and premix burner air lines.

- Restart gasifier blowers.
- Open FGR in pit.
- Close flue gas recycle by-pass valve.
- Open FGR motor valve.
- Open valves in gas line to gasifier lid and start small flow initially, building to a flow of 100 CFM flue gas, holding thermocouple in duct to below 1,000°C.
- Check main air blowers running, and adjust flow by opening premix throttle to give O_2 content of ~7 vol.% through lid. (Measure in flue gas O_2 meter.)
- Monitor thermocouples downstream of bed and adjust air flow to maintain temperature below 1,000°C.
- Increase gas flow through lid to 150 CFM towards end of burn-out while still maintaining downstream temperatures below 1,000°C.
- Purge fuel lines to injectors with kerosene by opening drains or disconnecting lines in pit. Run kero into a bag and have a dry powder extinguisher at the ready. Close fuel valves and reconnect fuel injectors.
- Burn out is complete when CO_2 in boiler flue gas begins falling.
- During burn out monitor bed temperature (T2).
- If temperature falls below 700°C and bed is sulphated, change to kerosene combustion:-
  - Close off air/FGR to lid, and air bleed via burner premix throttle.
  - Close FGR motor valve.
  - Set one fuel pump to deliver 56 lbs./hr.
  - Check trace heating is on and hot.
  - Remove plug from air inlet to gasifier blowers.
  - Open plenum valve and adjust to 170 CFM by opening air motor valve.
  - Start fuel pump and open fuel valves to injectors.
  - Continue combustion till bed temperature rises to 850°C.
  - Maintain watch on downstream thermocouples while bed is being heated up.
  - At 850°C - shut off fuel pump and close fuel valve.
  - Shut off plenum valve and close air motor valve.
  - Open FGR motor valve.
  - Continue decoke from "Carbon Burn Out Procedure".

- If temperature falls to 700°C, and bed is sulphided:-
  - Close off air/FGR to lid, and air bleed via burner premix throttle.
  - Close FGR motor valve.
  - Remove plug from air inlet to gasifier blowers.
  - Open plenum valve.
  - Adjust air flow to 170 CFM using air motor valve.
  - Continue until temperature rises to 850°C.
  - Maintain a watch on downstream thermocouples.
  - At 850°C close plenum valve.
  - Open FGR motor valve.
  - Continue decoke from "Carbon Burn Out Procedure".
- If re-heat of sulphided bed fails to reach 850°C, and temperature starts to fall because bed carbon is depleted and sulphide oxidised to sulphate, resume under "Temperature fall during decoke with sulphated bed".

Completion of Carbon Burn Out

- When CO_2 level in flue gas starts to fall, indicating completion of burn out:-
  - Close air plus FGR to lid.
  - Close FGR valve in pit.
  - Close FGR motor valve.
  - Remove plug from air inlet to gasifier blower.
  - Remove plug from sample cyclone.
  - Increase N_2 to fines return to 4 CFM each.

Restart After Shut Down

(a) From Sulphated Bed after Carbon Burn Out

- After "Completion of Carbon Burn Out" procedure:-
- Reconnect CO_2 analyser to sample system, zero and check calibration.
- Resume kerosene combustion using as a check list the procedure under "Boiler Clean Out" after the boiler door has been closed.
- Go to procedure for "Change from Kerosene Combustion to Fuel Oil Combustion", but omit final step of holding 870°C for one hour.
- Go to procedures for "Change Over from Combustion to Gasification" and "On Gasification".
- Resume test programme.

(b) **From Sulphided Bed After Carbon Burn Out**

- After "Completion of Carbon Burn Out" procedure:-
- Reconnect SO_2 analyser to sample system, zero and check calibration.
- Check main burner pilot or re-establish, see "Start main flame pilot light".
- Activate alarm bells except main flame.
- Check cooling system levels/pressures/flows/bleed.
- Check FGR blower on.
- Check FGR valve in pit is closed, and close FGR motor valve.
- Check trace heating is on and hot.
- Verify operation of main flame detectors.
- Check boiler pilot alarm and verify visually.
- Verify all other alarms except main flame.
- Set high temperature alarm on gasifier to 1,000°C.
- Main flame alarm muted and auto shut down inoperative.
- Set fuel pumps to deliver [illegible] lbs./hr. total. Arrange flows such that equal volumes flow down each injector with all pumps on.
- Open plenum valve.
- Adjust air to 170 CFM.
- Quickly open FGR valve to 30 CFM.
- Start air to regenerator and adjust to 15 CFM.
- With sulphided bed allow gasifier temperature to rise to 850°C.
- At 850°C simultaneously switch on two pumps totalling [illegible] lbs./hr. and start stop watch.
- At 8 sec. reset main flame failure alarm (MFFA).
- If MFFA cancels switch off mute and arm auto shut down.
- Proceed to "On Gasification".
- At 9 sec. reset MFFA and repeat as above.
- At 10 sec. reset MFFA and repeat as above.
- At 11 sec. reset MFFA and repeat as above.
- If MFFA has not cancelled at 11 sec. switch off pumps immediately.
- At 21 sec. switch off main air blowers and proceed as for "Restart After Shut Down".
- Investigate causes for failure to ignite, rectify and repeat.

(c) **From Sulphided Bed Without Carbon Burn Out**

- If emergency shut down has been effected find the cause of shut down and rectify.
- Check fuel oil fire valves are open, and oil circulating pump is operating.
- Check red light is out on auxiliary panel.
- Check main burner pilot or re-establish, see "Start Main Flame Pilot Light".
- Activate alarm bells except main flame.
- Check cooling system levels/pressures/flows/bleed.
- Check POR blower on.
- Set N_2 to fines return 4 CFM each.
- Check POR valve in pit is closed, and close POR motor valve.
- Check trace heating is on and hot.
- Verify operation of main flame detectors.
- Check boiler pilot alarm and verify visually.
- Verify all other alarms except main flame.
- Set high temperature alarm on gasifier to 1,000°C.
- Main flame alarm muted and auto shut down inoperative.
- Set L.H. and R.H. fuel pumps to deliver 898 lbs./hr. total. Arrange flows such that equal volumes flow down each injector.
- Open plenum valve.
- Adjust air to 170 CFM.
- Quickly open POR valve to 30 CFM.
- Start air to regenerator and adjust to 15 CFM.
- Allow gasifier temperature to rise to 850°C.
- At 850°C simultaneously switch on two pumps totalling 898 lbs./hr. and start stop watch.
- At 8 sec. reset main flame failure alarm (MFFA).
- If MFFA cancels switch off mute and arm auto shut down.
- Proceed to "On Gasification".
- At 9 sec. reset MFFA and repeat as above.
- At 10 sec. reset MFFA and repeat as above.

- At 11 sec. reset MFPA and repeat as above.
- If MFPA has not cancelled at 11 sec. switch off two larger pumps immediately.
- At 21 sec. switch off main air blowers and proceed as for "Restart After Shut Down".
- Investigate causes for failure to ignite, rectify and repeat.

Sampling of Hot Bed Material

- Wearing of asbestos gloves is recommended for this operation.
- Ensure that both bleeds are at 2.5 CFH.
- Open sample pot exit valve and drain leg valve, and drain bed material into 28 lb. keg until red hot bed material appears - rod out drain leg if necessary.
- Close exit valve and fill sample pot with hot bed material (~ 4 lbs.) observe through sight glass.
- Leave N_2 purge and leave sample to cool (~ 30 mins.).

Rodding Out

- Wearing of asbestos gloves and a face-mask is necessary, and in some instances, for example rodding from the top of the cyclones, full breathing apparatus should be used.
- Turn on N_2 to rodding lance and set at high flow rate. N.B. too high a N_2 flow may trip the safety switch on the Compton compressors.
- Remove plug, insert and position N_2 lance in rodding port before opening valve.
- After rodding withdraw lance beyond valve, but not fully out and close valve.
- Care should be taken when rodding fuel injectors, fines return pipes or manometer tappings where a significant positive gas pressure exists on the other side of the blockage. A cloth wrapped (like a scarf) round the neck inside the overalls will save neck burns. In the case of regenerator tappings remember the gas stream will contain [illegible] vol.% SO_2.

Injection of Toxic Gases

This will only be carried out by a qualified person fully familiar with toxicity of handled materials, and with safe handling and test procedures.

Injection shall take place only when another shift supervisor is present and observing the following precautions.

(a) Both sliding doors to gasifier area open.

(b) Access of personnel not involved in test to gasifier area must be prevented by posting sentries.

(c) Full breathing apparatus should be worn by tester and back-up man.

(d) All equipment should be leak tested before use.

(e) On the spot analysis for toxic materials of atmosphere in main pilot plant area and control room must be carried out throughout test period with a Dreger.

(f) Samples and any necessary readings outside the control room will be taken by the nominated person only.

Preventive Maintenance and Sampling During Run

The following action items should be carried out on a regular basis throughout the run as indicated below.

- Blow out pressure tapping lines and zero manometers (every shift).
- Zero and calibrate analytical instruments/change filters (day shift only).
- Rod out flue gas sample line - change filter on flue sample line and regenerator sample line, and empty knock-out vessel (every shift).
- Clean fire eyes on boiler (every shift)
  - Check if red light is on at boiler control panel, showing rear door fire eye is seeing a flame. If light is on, remove and clean front fire eye first, then clean rear door fire eye. If light is off, clean rear door fire eye first, then front fire eye.

    Always check red light is on at boiler panel after cleaning rear door fire eye.

    Failure to follow this sequence for cleaning fire eyes may result in an automatic shut down.
- Oil dust extractor fan bearings located in roof and grease boiler water cooling pump, and boiler water circulating pump (2 grease points each) (every shift).

- Check blowers for belt wear (a) blower house (2) (hourly - see data sheet 4)
  (b) regenerator (3)
  (c) cooling fan on roof
- Bleed air from boiler water system - 3 points.
- Every six hours take gasifier and regenerator bed samples and gasifier cyclone (L.H.).
- At 12.00 and 24.00 take gasifier, regenerator, regenerator cyclone, boiler back and boiler flue, gasifier cyclones (2) samples.

VII GLOSSARY OF TERMS

Watt (W)	=	Basic unit of energy rate.
Watt electrical (We)	=	Rate of production of electric power. A power generation boiler fired at a rate of 100 MW, in terms of fuel energy input, will produce 30 MWe at an overall thermal efficiency of 30%.
Vacuum bottoms	=	The petroleum residue recovered from the reboiler of a vacuum pipestill. Typically about 50% by volume of the residue from the reboiler of an atmospheric pipestill.
Ca/S	=	The mol ratio of the rate of calcium in the fresh stone fed to the gasifier vs. the rate of sulphur entering the gasifier in the fuel.
Air/Fuel ratio	=	The total oxygen entering the gasifier bed as air and flue gas as a percentage of the stoichiometric oxygen needed to fully combust the fuel.
S.R.E.	=	Sulphur Removal Efficiency $=(1-\frac{SO_2 \text{ Observed in flue gas}}{SO_2 \text{ if none absorbed}})\times 100\%$
Bed sulphation	=	Oxidation of a bed of lime containing carbon and calcium sulphide, resulting in a bed containing lime and calcium sulphate only under controlled temperature conditions such that no SO_2 is released by regeneration of the bed.
Combustion	=	Operation at high excess air levels during combustion in the gasifier such that the gasifier temperature remains at the required level (Air supply about 400% of that needed to fully combust the fuel).
μ	=	Micron (10^{-6} metre)

IX INVENTIONS

1. UK 551786 J.W.T. Craig, R.F. O'Neill, D.L. Keairns

A process for reacting spent lime from the CAFB with air to oxidize calcium sulphide to calcium sulphate followed by reaction of the remaining calcium oxide with CO_2 to form calcium carbonate.

2. UK 551788 J.W.T. Craig

The inerting of spent lime from the CAFB by exposure to temperatures sufficiently high to sinter the stone surface and render it relatively inert to reaction with the elements.

3. UK 16143/74 J.W.T. Craig
US 557080

A process for reacting SO_2 from the CAFB regenerator with fine particles of spent lime to form calcium sulphate.

4. UK 47103/74 G. Moss

Fuel injectors are protected from exposure to hot bed material in extensive fluid beds by contouring the heights of air distributor nozzles to allow zones of slumped bed through which the fuel injectors pass.

5. UK 53536/74 G. Moss

A slurry of water and waste lime from the CAFB regenerator is used to scrub SO_2 from the regenerator off gas, part of the slurry being recycled and part concentrated by settling, the settled material being dried by injection into a hot agglomerating fluid bed, and dumped when agglomerated to an adequate size.

6. UK 55373/74 G. Moss

Coke deposits formed in cyclones and ducts downstream of a CAFB gasifier are removed by elutriating abrasive particles in the gas stream leaving the fluidised bed. The particles scour the ducts and cyclones and are retained by the cyclones for return to the gasifier bed.

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Phase II Bench-Scale Research on CSG Process, R&D Report No. 16. Report to Office of Coal Research, Contract No. 14-01-0001-415, Consolidation Coal Co. July 1st, 1969.

7. UK 10277/75 J.W.T. Craig, G.L. Johnes, G. Moss

Tar and coke deposits in ducts and cyclones upstream of a CAFB product gas burner are removed by a sliding air supply duct which closes off the gas supply to the combustion furnace (e.g. boiler). Air is supplied to the gas supply chamber in the burner so that deposits are ignited starting at the burner and proceeding backwards down ducts and cyclones to the gasifier.

8. UK 10731/75 G. Moss

Fuel oil is injected into the regenerator bed of a large CAFB gasifier adjacent to the transfer point from the regenerator to the gasifier. This improves the desulphurization efficiency of the unit and reduces residual calcium sulphate to SO_2 or elemental sulphur.